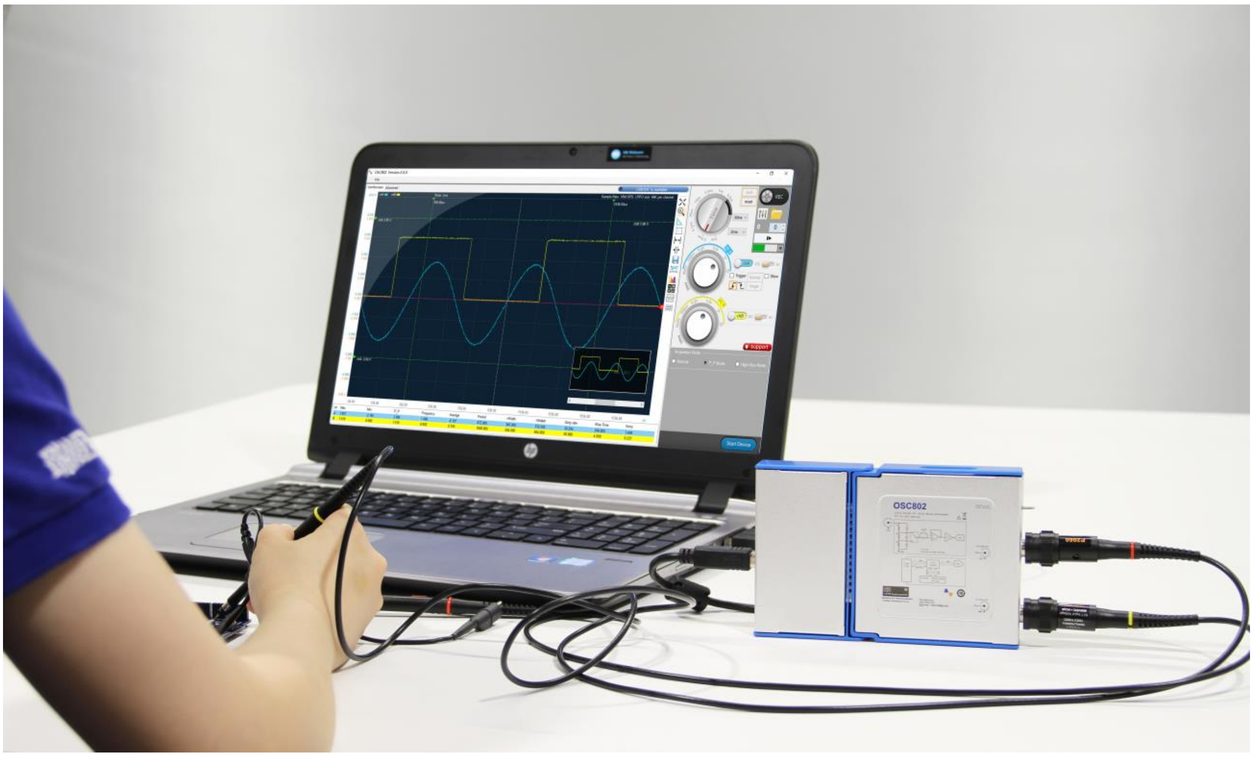
OSCxxx PC Oscilloscope

Software User's Manual



Contents

1 Welcome

Thanks for choosing OSCxxx portable oscilloscope solutions. LOTO Instruments is committed to the development of high performance software for virtual instrumentation products. It has been committed to the research and development of virtual instruments for many years, improving the cost, the functional architecture of traditional instruments and providing cost-effective products. Welcome to contact us (173393190@qq.com) for any suggestion, customization development or business cooperation.

2 Software Version

This manual describes the common software features of all models. The hardware specifications of different models can be found in their respective data sheets. This manual is based on the software version in the list below.

<table>
<tr><th colspan="2">Model</th><th>Software version</th><th>Release date</th></tr>
<tr><td rowspan="3">OSC482</td><td>OSC482</td><td rowspan="3">version 3.9.0</td><td rowspan="3">2019/06/21</td></tr>
<tr><td>OSC482S</td></tr>
<tr><td>OSC482X</td></tr>
<tr><td colspan="2">OSC802</td><td>version 3.2.0</td><td>2019/06/12</td></tr>
<tr><td rowspan="2">OSCA02</td><td>OSCA02</td><td rowspan="2">version 2.7.0</td><td rowspan="2">2019/06/11</td></tr>
<tr><td>OSCA02L</td></tr>
<tr><td rowspan="2">OSC2002</td><td>OSC2002</td><td rowspan="2">version 2.5.1</td><td rowspan="2">2019/06/11</td></tr>
<tr><td>OSC2002L</td></tr>
</table>

3 Software and driver down load

To make sure LOTO users could have the best experiences and better products, we keep updating oscilloscope software-correcting bugs, adding practical features, and improving software operations.

The latest version of software &driver &documents will be updated to the link:

http://bbs.lotoins.com/support.html

No matter when you download, you will download the latest version. There is no fixed schedule of updates, we usually release a new version in every one or two months.

4 Safety Warning

△ 1 **Make sure that the input of the device does not exceed the voltage range.**

△ 2 **Make sure that the black clip of the probe is well grounded and equipotential to the PC power supply during measurement.**

△ 3 **Do not connect the probe to the mains voltage socket (110V / 220V).**

WARNING!	Damages caused by violation of this safety warning will not be covered by the warranty.

△ 1 note: the oscilloscope device has an input range of ±5v and it should never be exposed to higher voltages although it has an over-voltage protection circuit which can protect the device from voltages even ten times the maximum allowed.

To avoid the risk of damage, it is required to select an input probe with the attenuation factor according the nature of the voltage to be measured to ensure that the device is used within the voltage range.

The device is provided with a 1X/10X probe: when the 1X position is selected, the voltage input range is ± 5v. When the 10X position is selected, the voltage input range is ±50v. If an optional 100X probe is used, the voltage input range is ±500v.

△ 2 note: the virtual oscilloscope device takes power directly from the USB port of the PC, so its ground is connected to the PC ground as also the black clip of the probe. If the PC is powered by the power supply from the mains voltage socket, then the PC should be connected to the ground through a 3-hole power socket. In case the device is connected to a PAD or laptop and these are powered just by a battery, then the ground will be suspended. But in most cases, the device ground, PC ground and probe black clips are all connected to the ground. If the black clip is used to connect a non-earth potential in the circuit under test, it is equivalent to short-circuiting the circuit under test with the black clip directly to the ground.

△ 3 note: as described in △ 1, measuring 220V mains voltage is equivalent to measuring a voltage signal with a peak-to-peak value of about 611V. In this case it would be necessary to use a high source voltage probe with attenuation 100:1.

In addition, as described in △ 2, when the probe is connected directly to 220VAC, it is equivalent to passing 220VAC L or N through the oscilloscope's probe GND line and from this to connect it to the oscilloscope's internal GND and to the AC input protection ground.

In severe cases, the probe or oscilloscope may be burned, and since the oscilloscope itself (such as the metal parts of the case) is electrically connected to the probe GND, it could be dangerous for the human body. For this to measure mains, use a differential isolating probe

specifically designed for a high source voltage.

5 Minimum System Requirements

Operating system	Microsoft Windows XP, Win 7, Win 8, Win10. Supports both 32 and 64-bit systems.
CPU	2.0GHz or above
RAM	1.0GB or above
Software package	.net framework 2.0
Screen refresh rate	60 Hertz
Ports	USB 1.1 compliant port minimum. USB 2.0 compliant port recommended. Must be connected direct to the port or a powered USB hub. Will not works on a passive hub.

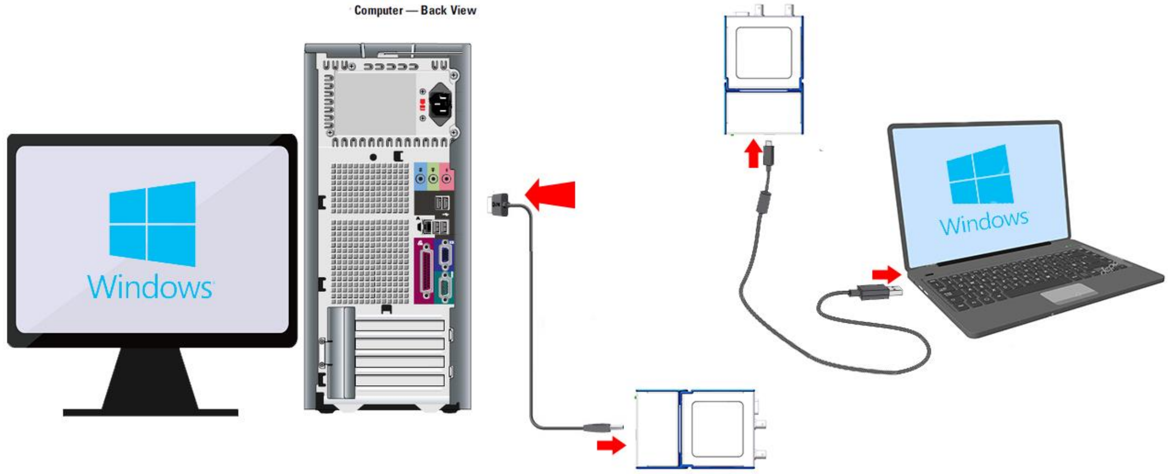
Warning

The software application requires Microsoft .NET framework 2.0. This component is an integral part of Windows systems since Win 7, so there is no need to install it on these systems, however on Windows XP system it may be required to install this component to use the software. The software installation process will determine if this component is required and will download and install it if necessary.

6 Using OSCxxx for the first time

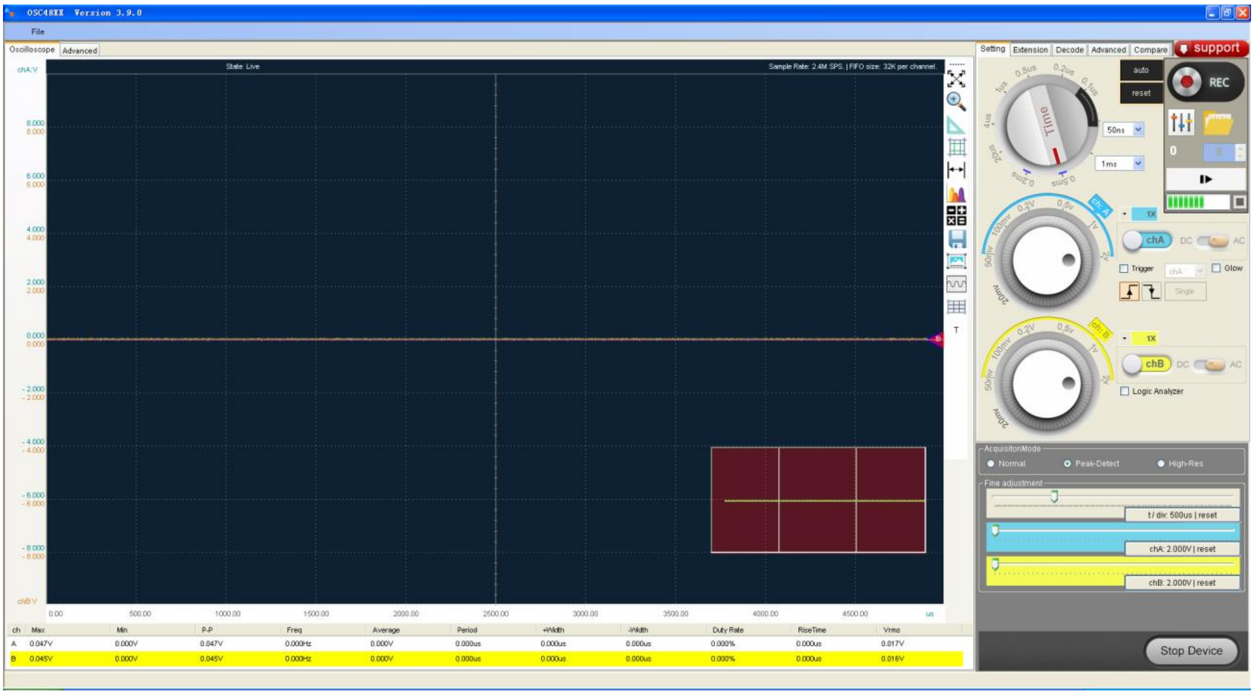
We designed this virtual oscilloscope to be as simple as possible. Even connecting it for the first-time can be quick by following the steps below.

(1) : Connect the virtual oscilloscope to the PC via the supplied USB cable. You should use only the supplied USB cable, or use a cable of a better quality. Poor quality cables may cause communication problems or may become unusable. If you are using the device on a desktop PC, be sure to connect it to the USB port on the back of the chassis. The front ports may also be unstable due to power supply issues. If you use a laptop, it is easy to connect to the USB ports on the sides.



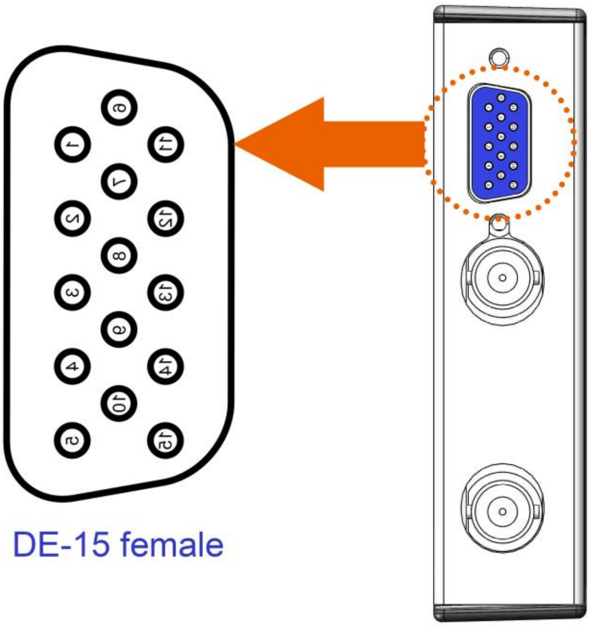
(2) : Install the driver. When the virtual oscilloscope is connected to the PC for the first time, in Win 8.1 and Win10 systems the device driver will be automatically recognized and installed. In Win XP and Win 7 32-bit operating systems the device will be recognized, and the system will require the driver installation. The steps for installing the driver are different according the operating system. See Sections 8.1 and 8.2 for more information on the specific installation process.

(3): Open the virtual oscilloscope software, click the **Start Device** button in the lower right corner, then you will see that channel A has been turned on by default, with the zero-voltage baseline in the middle of the screen. Channel B can be enabled in its setting area. When the zero-voltage baseline is in the vertical center, this indicates that the virtual oscilloscope is operating normally.

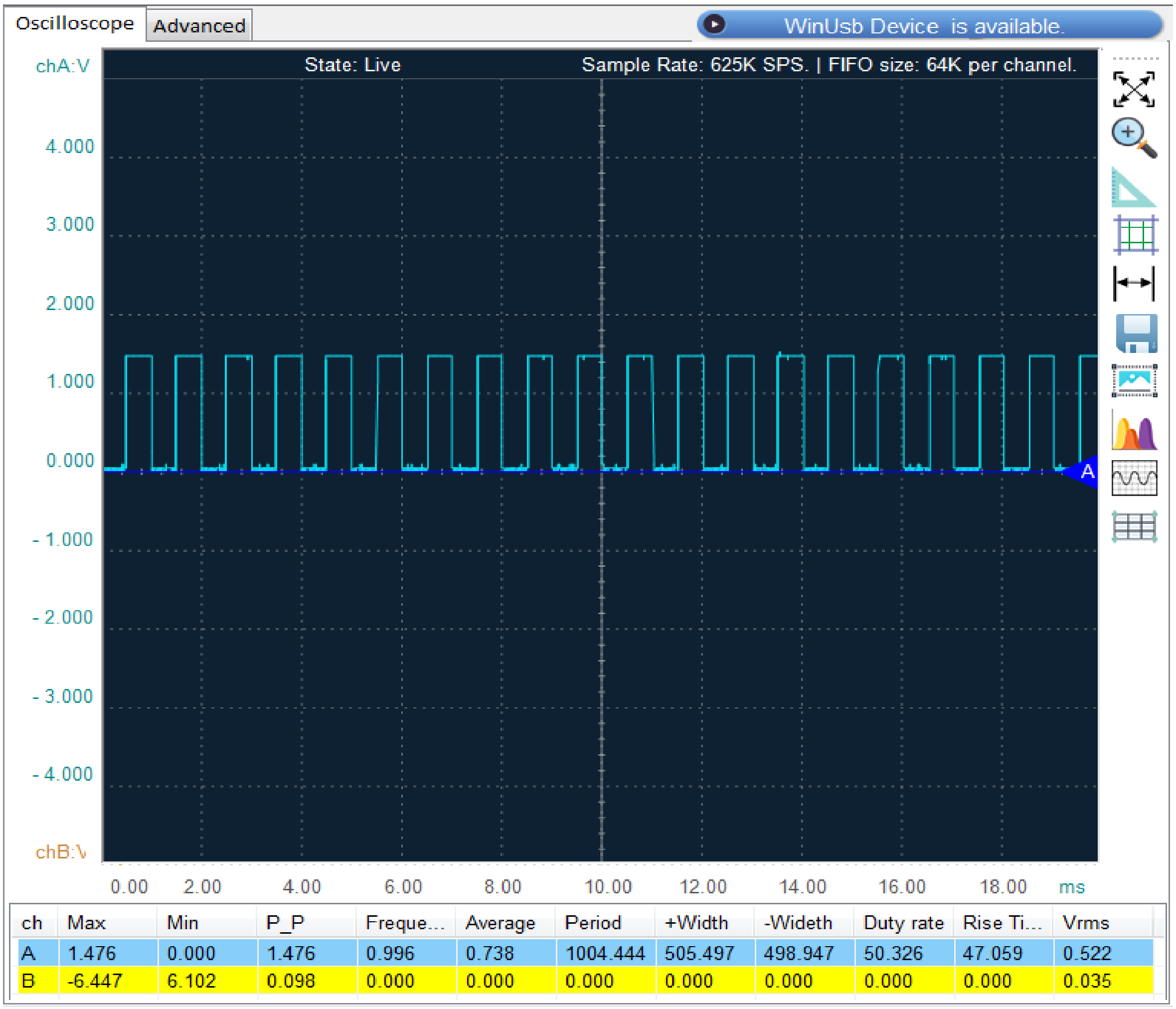


(4): Use the standard probe calibration signal to display your first waveform on the screen. Some kind of device has an extended metal contact next to the two BNC input connectors that output a square wave with amplitude of approximately 1.5V and a frequency of 1 KHz. The other kind of device has this square wave output in pin 6 of a DE-15 interface.

1: L4
2: IO1/Lctrl
3: LO2/Ext trigger
4: IO3
5: chB input
6: square wave(1k)
7: L2
8: DGND
9: IO4/L1
10: DGND
11: L3
12: 3.3V
13: -5V
14: 5V
15: AGND



This signal allows a quick check whether the product is working normally when there is no other AC signal at hand. Set one probe with x1 selector; connect it to the oscilloscope channel A port from the BNC connector side and to the metal contact on the other side. Adjusts the time knob in the software to 1ms position. The square wave will appear on the screen.



7 Drivers Installation

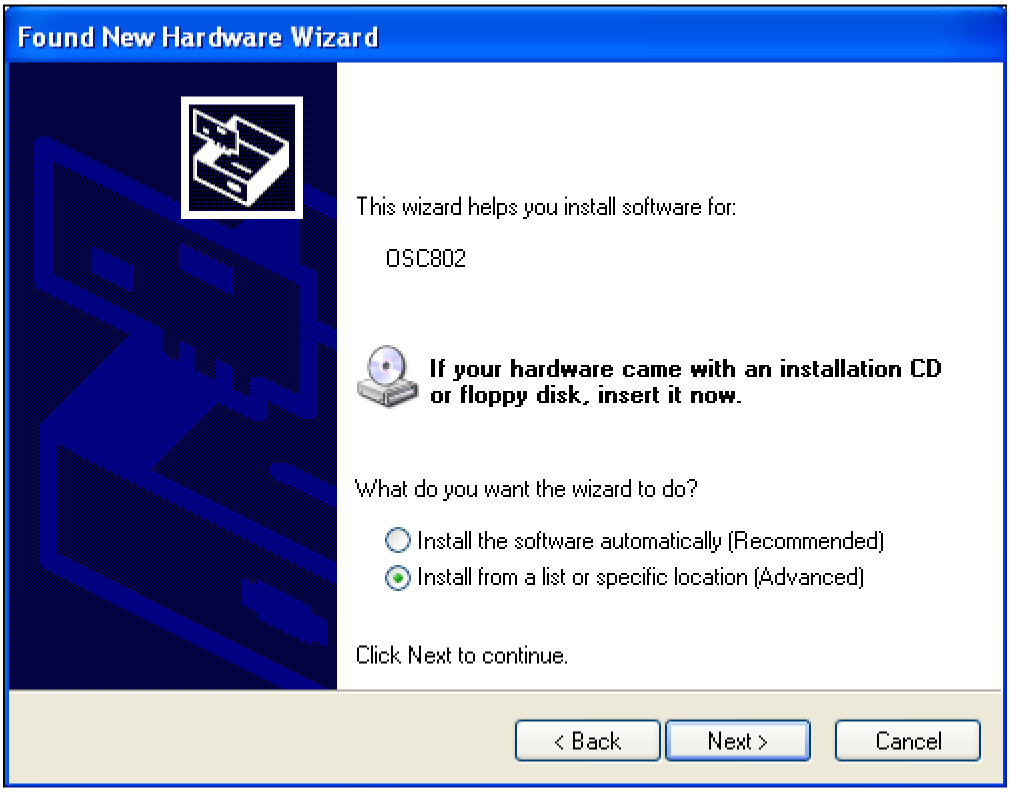
This chapter describes the detailed steps of installing drivers for this product under various types of Windows operating systems, which can cover the guidance most users need to install drivers. However, in some users' operating systems, there will be exceptional situations of driver conflict, which will lead to the failure of driver installation or the failure of normal opening of the device when the installation is successful. Users can refer to the detailed solutions for driver installation under exceptional circumstances listed in Appendix 1 of this manual.

7.1 Driver installation on Windows XP

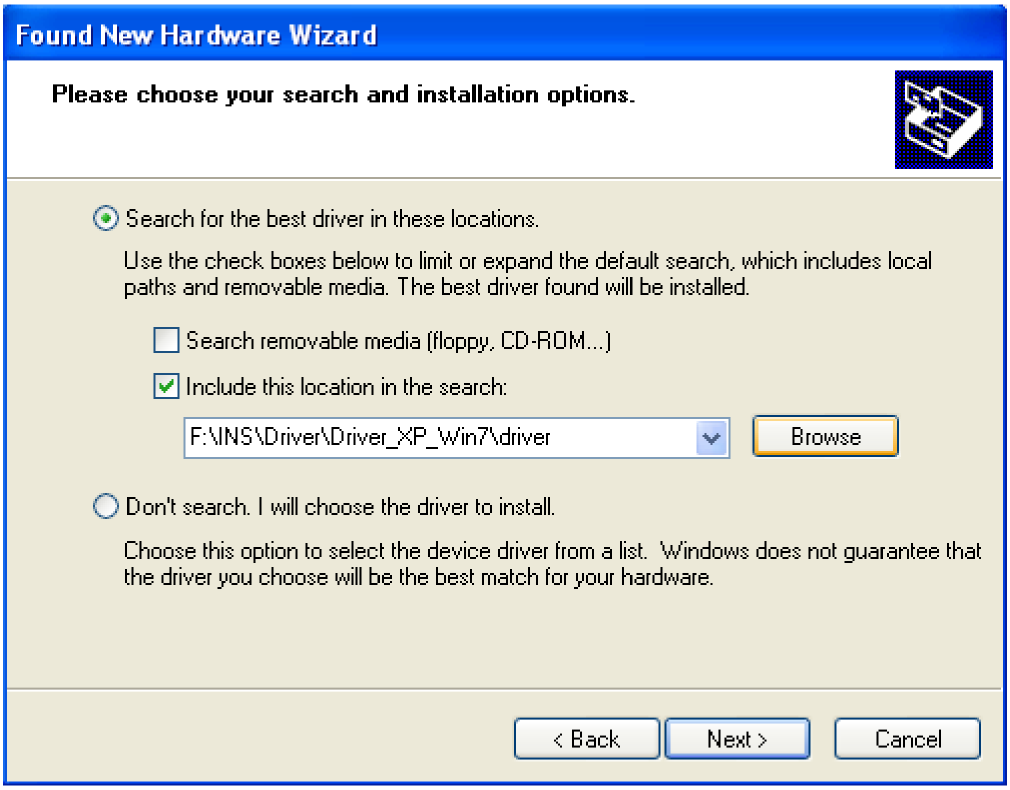
1: Select "Install from a list or specific...", then click on "Next" :

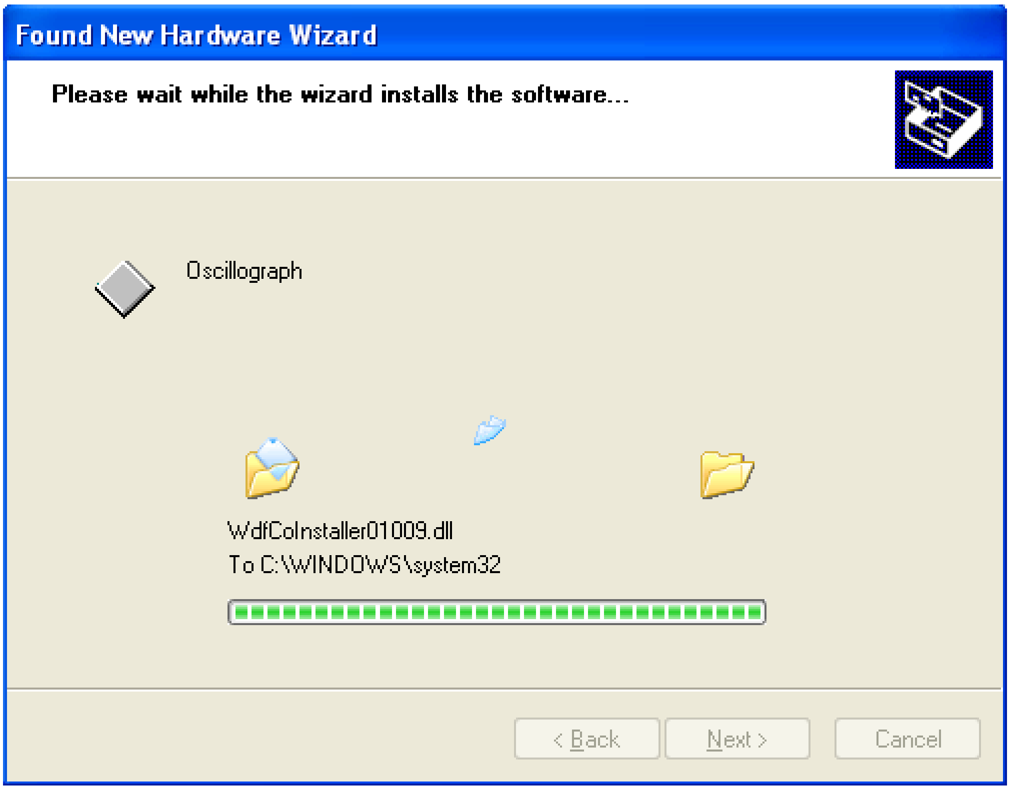
Note:
For install the driver manually right clicks on **Computer** and select **Manage** so to enter in the **Device Manager**. In **Other devices** search the device with name **OSCxxx.** Then right click on it and select **Update Driver.**



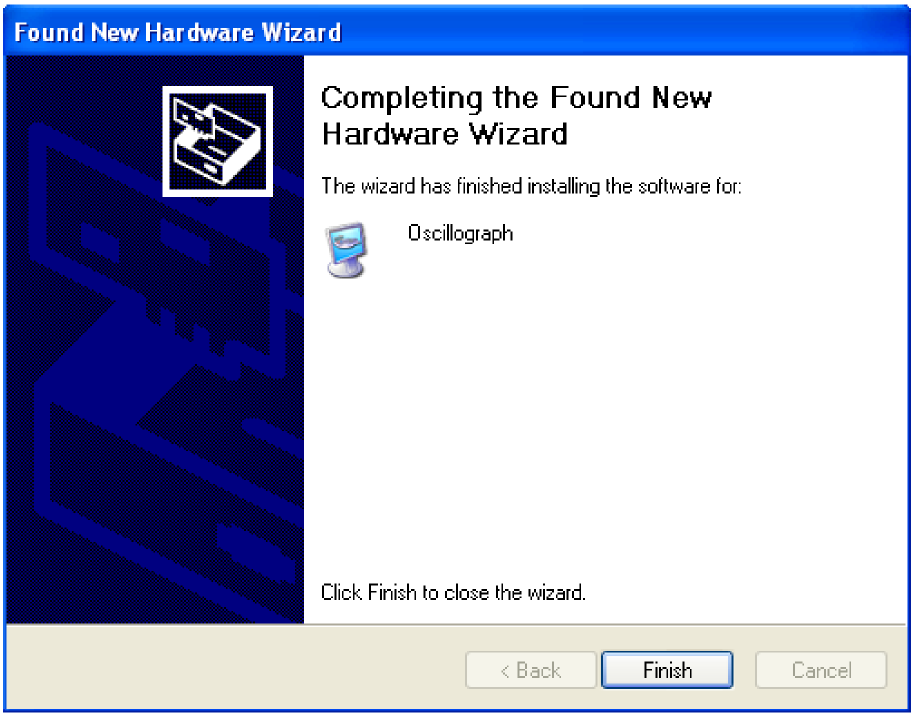


2: Click on **Browse**, specify the search path as "(software installation package path)*driver*". For example "Driver_XP_Win7\driver", then click **next**:





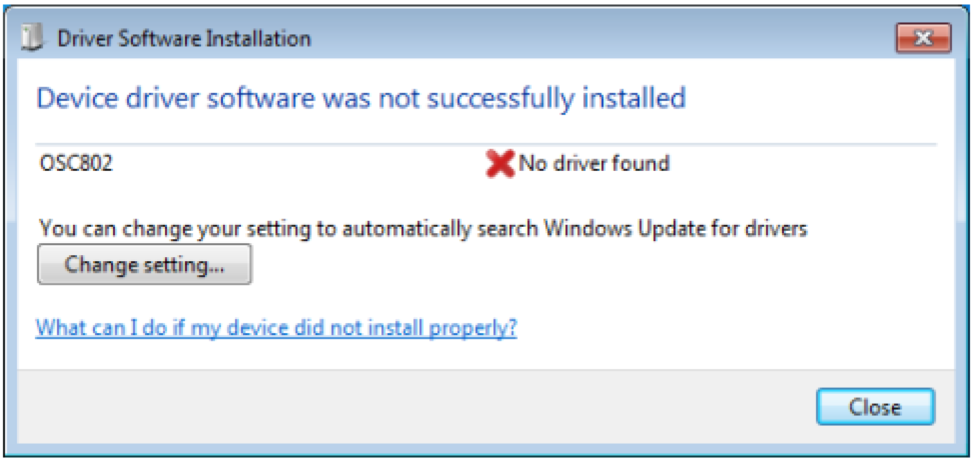
3: Once the installation is complete, you can see the installed driver in the **Device Manager**:



7.2 Driver installation on Windows 7 - 32 bit

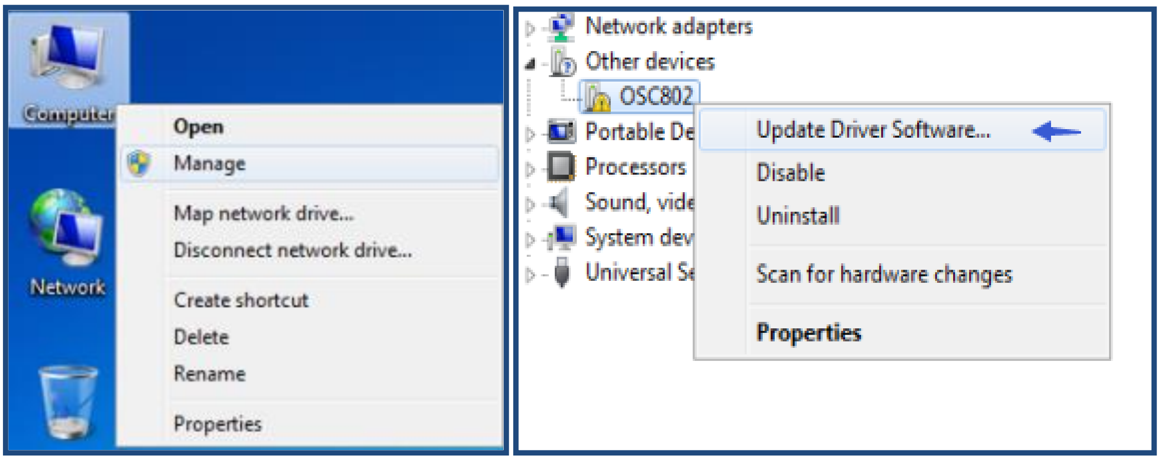
> **Warning:**
> Windows 7 – (32bit and 64 bit) cannot install the driver automatically. It is required to install the driver manually.

Windows 7 will automatically search for the driver through Windows Update when the device is connected, but this automatic installation will fail since the driver is not present in the system:

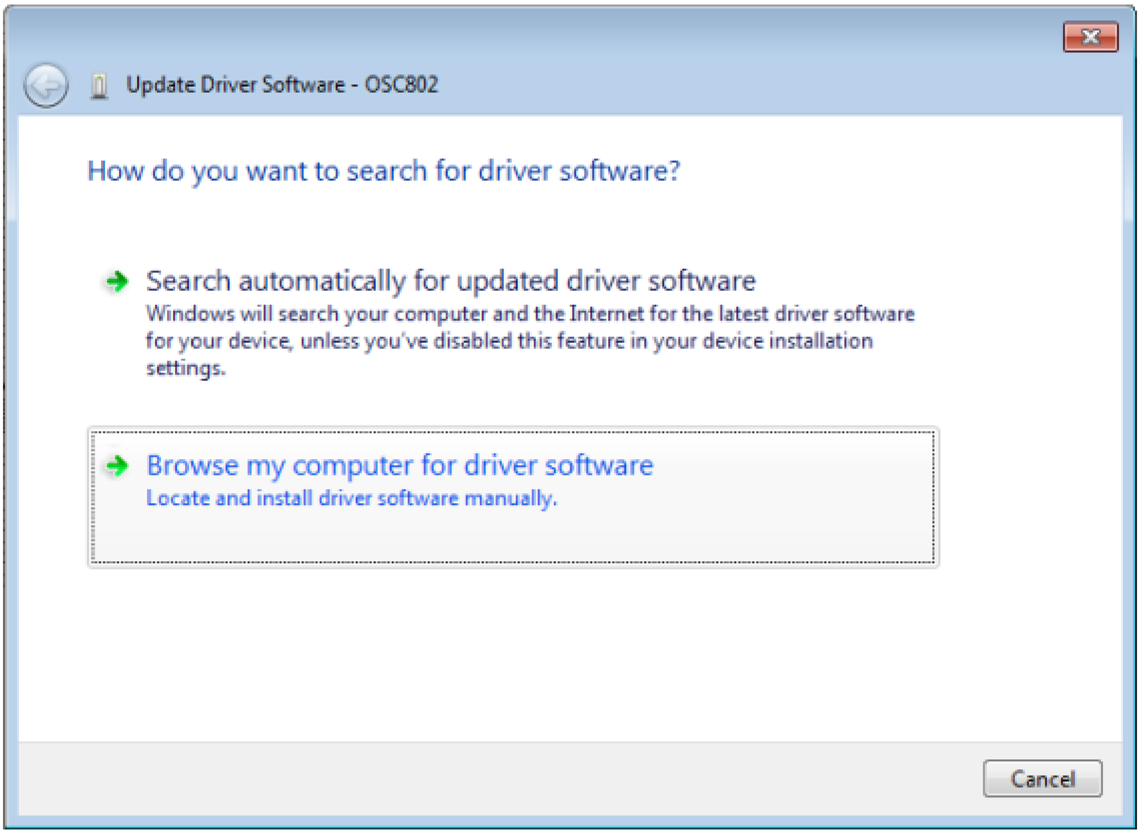


Manual installation:

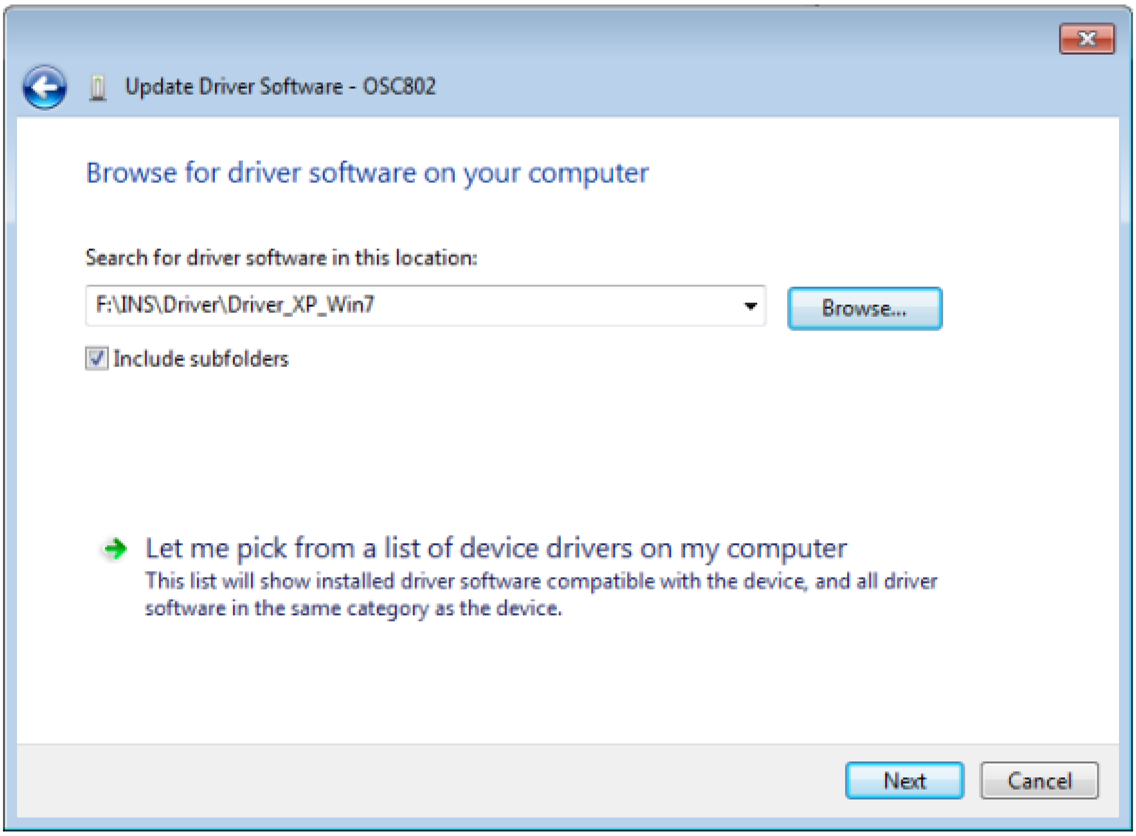
1. Right click on **Computer**, then select **Manage.** Enter in the **Device Manager**, search for the device with name **OSCxxx** with the yellow exclamation mark in **Other devices**, and then right click on it and select **Update the Driver Software**:



2. In the dialog box, select “Browse my computer for driver software”:

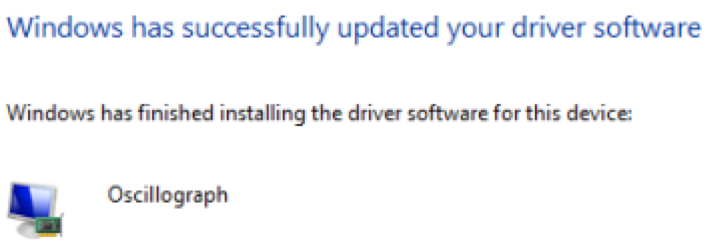


3. In the next dialog box specify the driver location as "*(Installation package path)\driver*" via the **Browse...** button. For example "*E:\ Driver_XP_Win7\driver*":



4. Select "Install this driver software anyway":





7.3 Driver installation on Windows 7 - 64 bit

Manual installation

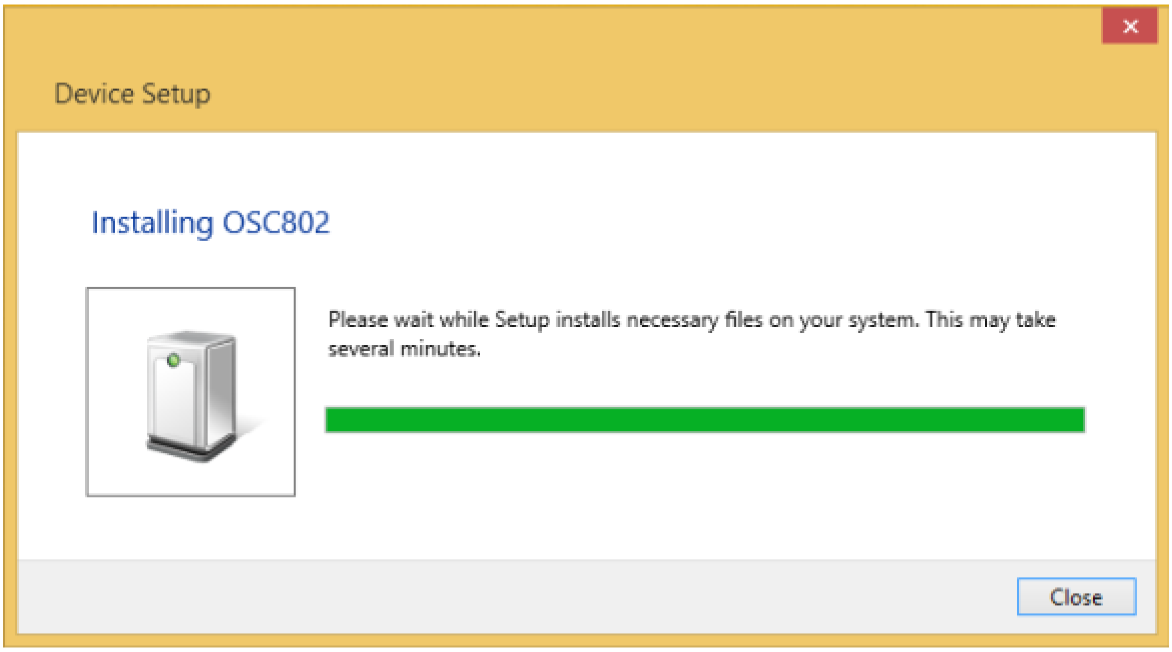
1. Right click on **Computer**, then select **Manage.** Enter in the **Device Manager**, search for the device with name **OSCxxx** with the yellow exclamation mark in **Other devices**, and then right click on it and select **Update the Driver Software**.

2. Use the **Browse...** button to specify the driver location as "*(Installation Package Path)\driver*". For example "*E:\ Driver_Win7_64\driver*".

3. Other steps are the same as for the above windows 7 32-bit system.

7.4 Driver installation on Windows 8 and Windows 10

The system will automatically install the drivers for the device, and the user does not need to proceed with any manual installation.



7.5 Driver installation issues solution

If the above steps still do not allow to install the driver properly, in Appendix I you can find a detailed solution.

8 Introduction to the software usage

This section describes the basic concepts and usage of the virtual oscilloscope software.

8.1 Some basic concepts on the PC virtual oscilloscope

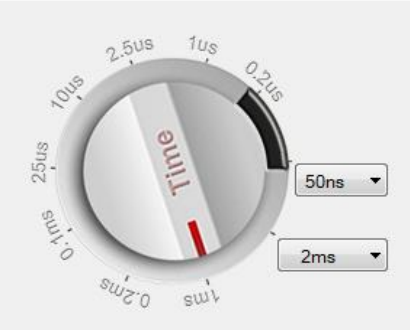
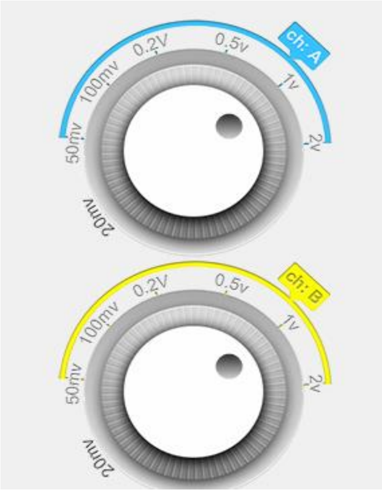
An oscilloscope is a measuring instrument that displays the relationship between voltage and time of an electric signal or a waveform.

When displaying the voltage-time relationship, the abscissa represents the time value (from left to right for the direction of time growth), and the ordinate represents the voltage value (from bottom to top for lower voltages to higher voltages).

Unit (Time)	Description
s	Seconds
ms	Milliseconds, that is, one thousandth of a second (10^{-3} s)
us	Microsecond, one thousandth of a millisecond (10^{-6} s)
ns	Nanoseconds, one thousandth of a microsecond (10^{-9} s)
v	Voltage in Volts
mv	Millivolt, that is, one thousandth of a Volt (10^{-3} V)

Waveform plots: In the oscilloscope software the drawing area of the waveform is evenly divided with grids which serve for quickly measurement on the signal.

The oscilloscope software interface provides two types of knobs for setting the grid units, one for the time and one for the voltage.

	Time axis setting. The value set by the knob will set the time span for the horizontal grid divisions.
	Voltage axis setting (one for each channel). The value set by the knob will set the voltage span for the vertical grid divisions. The voltage span can be different for each channel

All the input channels of this oscilloscope are synchronized in time, so they share the same time axis and the same time settings from the corresponding knob.

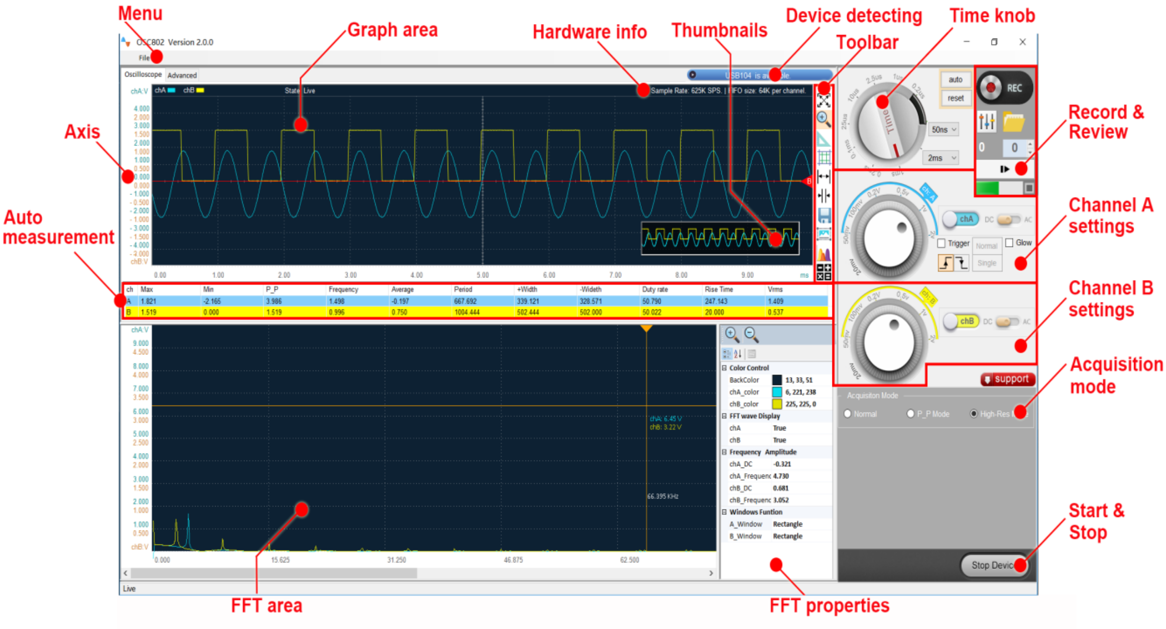
The sampling rate from the Analog to Digital converter in the oscilloscope hardware vary automatically according the selected time scale so to make a better usage of the device internal memory, without losing resolution in the time analysis.

8.2 Introduction to the Virtual Oscilloscope Software



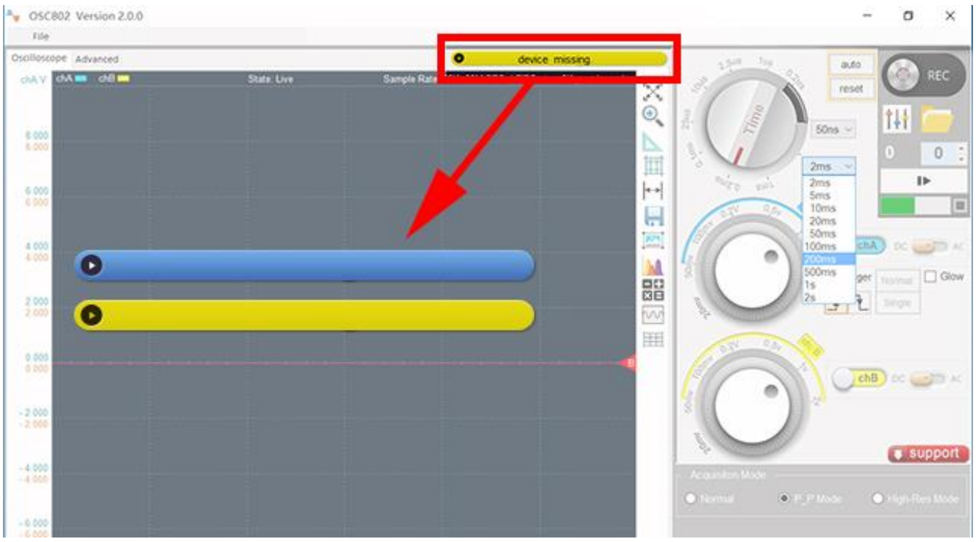
Double-click on the application icon to open it.

- If the application does not start probably it is due to an incorrect installation of the .NET Framework 2.0 under Win XP systems. In this case please refer to the relevant instruction in Chapter 8.
- If the application does not start under Win 7 / Win 8, it is possible that the issue is due to the system permission settings. In this case right-click on the application icon and select to **Run as administrator**.



8.2.1 Device monitoring

After the software interface is opened, the OSCxxx device status will be monitored in real time. When the device is connected on the USB port of the PC, the software interface will display a message on blue background. If the device gets disconnected physically or logically, the software interface will display a message on yellow background.



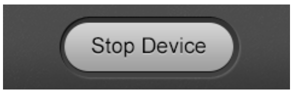
8.2.2 Start and stop

After the driver has been successfully installed, if the oscilloscope is connected when the software is opened, the software automatically turns on the device and starts the real-time acquisition. If the device is connected before opening the software, it is required to start the device manually by clicking on the **Start Device** button in the lower right corner of the software

or by pressing the **Enter key** （**shortcut key** (Enter) - start/stop） on the keyboard.



After the device is started the **Start Device** button becomes the **Stop Device** button which allows to stop the acquisition at any time. The acquisition can be stopped also by pressing the **Space Bar** on the keyboard or when the USB cable is unplugged during the operations.



The start/stop button can only control the device real-time acquisition, but it is not used for play/stop operations on past recorded data. In this case there are specific control buttons. For details, please refer to Chapter 9.2.8.

> **Note**
> When the device is not used it is recommended to close the software and then to unplug the device's USB cable.

8.2.3 Introduction to the Waveform display area

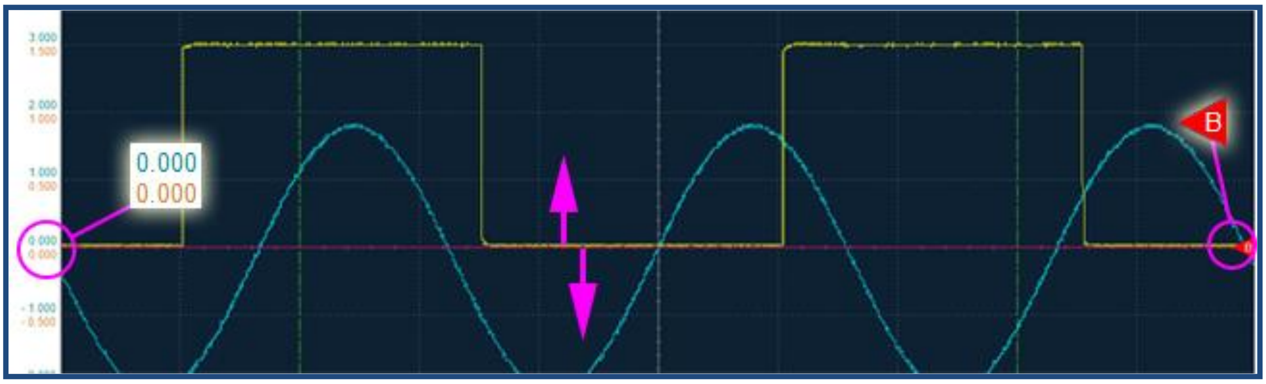
8.2.3.1 **Waveform curves**

The waveforms are drawn on the plot area using different colors to distinguish them. The default background color of the plot area is dark blue. The waveform for channel A (chA) and channel B (chB) are drawn respectively in cyan and yellow colors:
.

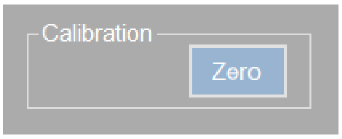
8.2.3.2 **Zero-voltage baseline**

The channel’s waveforms are drawn according their zero-voltage baselines. These lines represent 0 Volts; positive voltages are drawn above while negative voltages are drawn below the baselines. The zero-voltage baseline position of each channel is indicated by a horizontal line and a triangle on the side which can be dragged with the mouse to move the baseline. A number inside the triangle indicates the corresponding channel number. By default, the zero-voltage baseline is set in the middle of the screen for all channels. Channel A (chA) waveform and the channel B (chB) waveform uses respectively blue and red colors for the zero-voltage baselines, as: 
, 
. When the mouse is placed on the triangle of the zero-voltage baseline and the left button is clicked, you can drag up and down the line to change its position.

The zero-voltage baseline for each channel is identified by a triangle on the right side of the waveform display area. Channel A baseline is in blue while channel B baseline is in red. You can use the mouse to slide up and down these triangles to adjust the levels for the zero-voltage baselines. The grid values on the left axis will change accordingly. By default, the zero-voltage baselines for channel A and channel B are in the middle of the display area.



The user can self-calibrate the zero voltage level using this function. Zero level calibration is required since different environment conditions (as temperature) or aging of the hardware components. When calibrating the zero position, please be careful not to input any signal, just let the channel input hang.

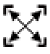


8.2.4 Waveform display toolbar

The display control functions can be accessed using the waveform display toolbar located on the right side of the waveform display area. When the mouse is placed over one of the buttons of this toolbar, a tooltip will show the name of the function corresponding to the button.

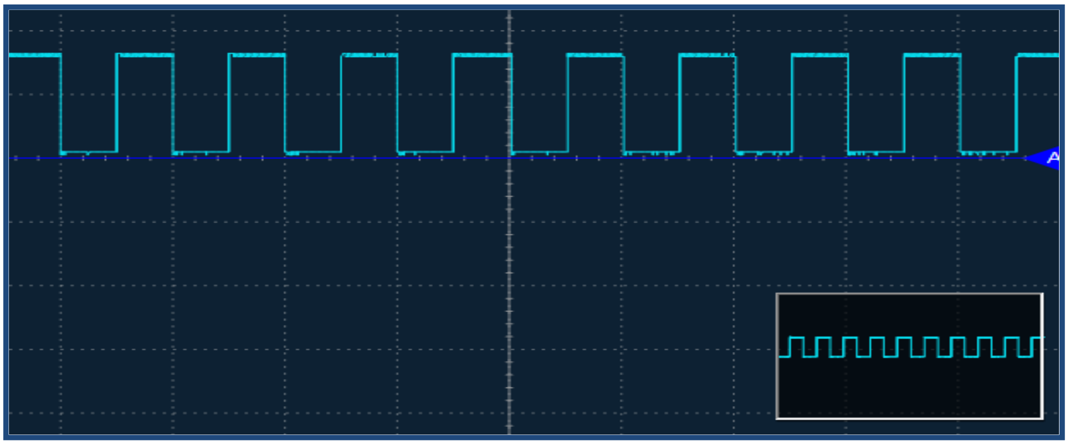


8.2.4.1 Default Display **button**

When  button is clicked, the waveform display area is restored to the default state, which is the original state according the knobs settings and without any zoom.

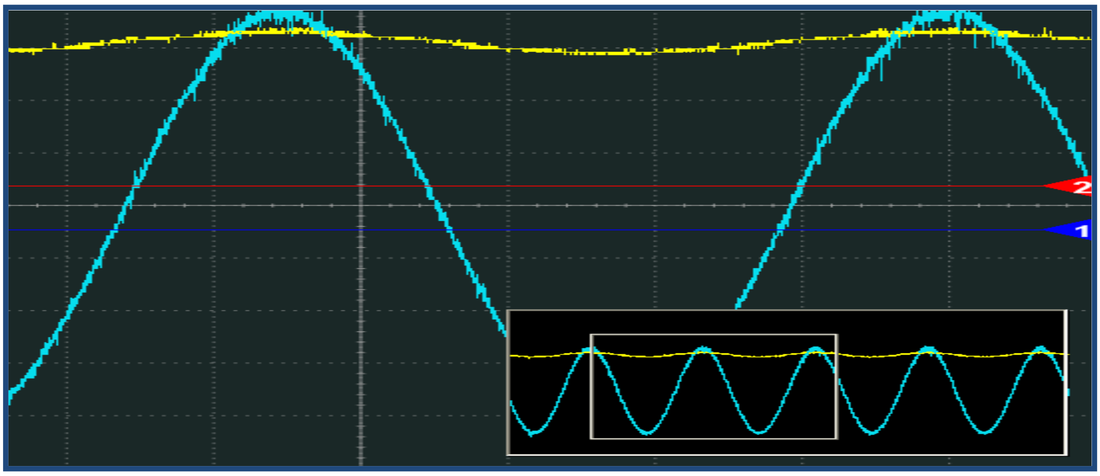
8.2.4.2 Zoom In **button**

When  button is clicked, the mouse cursor will become a cross and will allow to select an area for zooming. Press on the left button of the mouse to start the zoom area selection until the area of interest is no completely selected. Releasing the left button of the mouse, the selected area will be enlarged to the size of the full plot area.

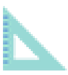


This operation can be repeated also in already zoomed areas. When this function is used a thumbnail appears in the lower right corner of the drawing area to allow to find the area currently selected and its position respect the full waveform area. This function will enlarge the horizontal and vertical coordinates simultaneously. If you want to zoom only according the horizontal axis and do not change the zoom level of the voltage axis, you can use the **X Axis Zoom** button, which will be introduced later.

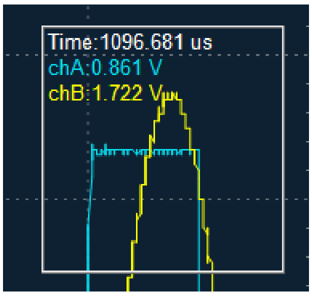
The **Default Display** button mentioned above allows to end the zoom-in state and to return to the original view state.



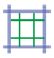
8.2.4.3 Ruler Measurement **button**

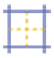
When  button is clicked, the mouse cursor will become a cross, allowing to select an area. Pressing the left button of the mouse the selection starts until the mouse button is not released. After the area has been selected the voltage and time span of the selected area will be displayed. Just one area can be selected with this tool so new selections overwrite the previous ones.

In white it is reported the time span. In the same color as each channel waveform is reported the voltage span selected of the corresponding channel. This measurement is convenient and mainly used for calculating time and voltage intervals.

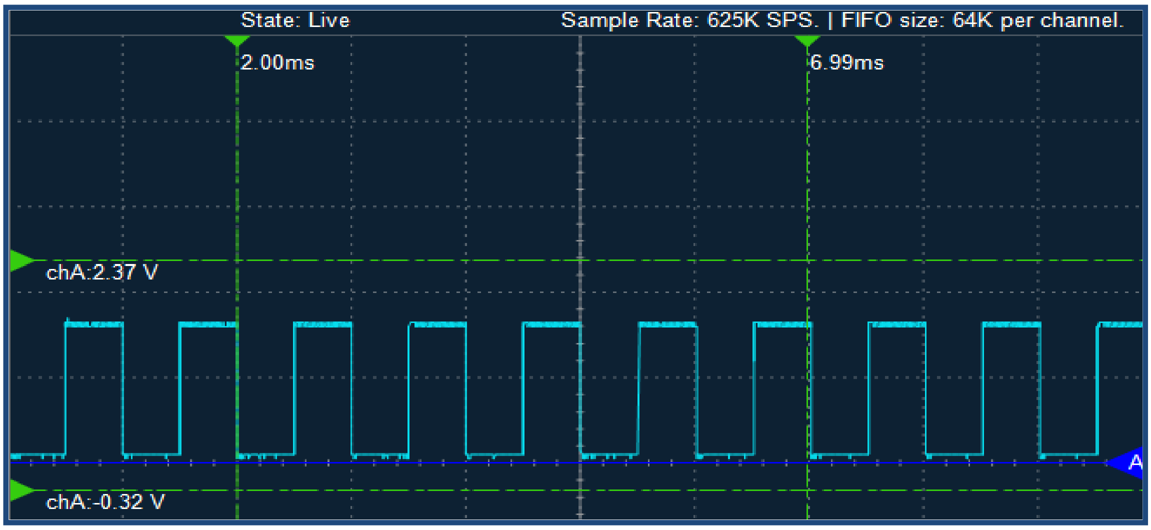


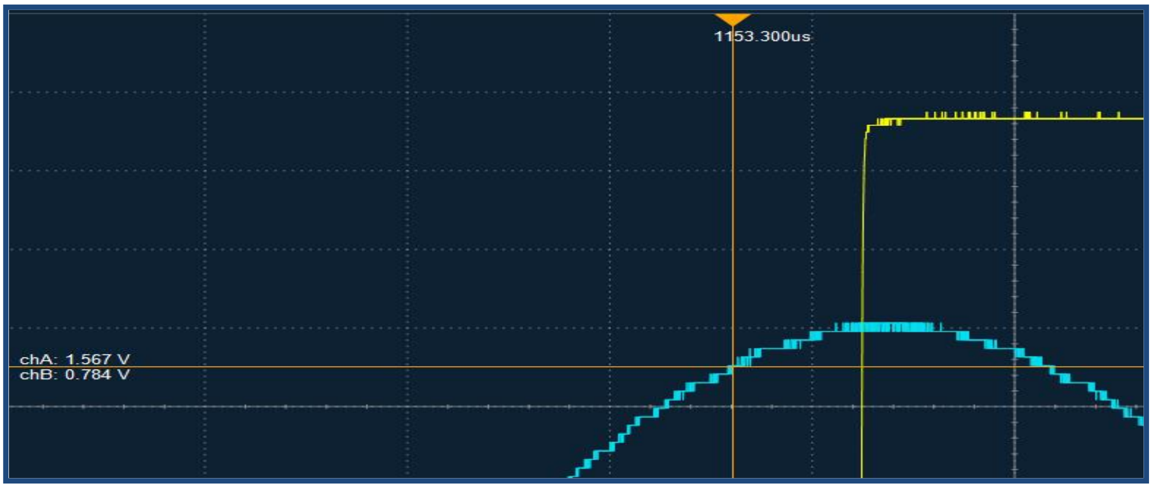
8.2.4.4 Markings / Cursor Measurement **button**

Clicking on  button, two green horizontal lines and vertical lines will appear in the display area. Dragging with the mouse the green triangle on the side of these marking lines, it is possible to adjust the position of the markings for data measurement.

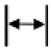
Clicking on  button, the marking measurement will become a cursor measurement. With this measurement an orange cross will appear in the drawing area following the mouse position and displaying the horizontal and vertical coordinate data of the cursor position.

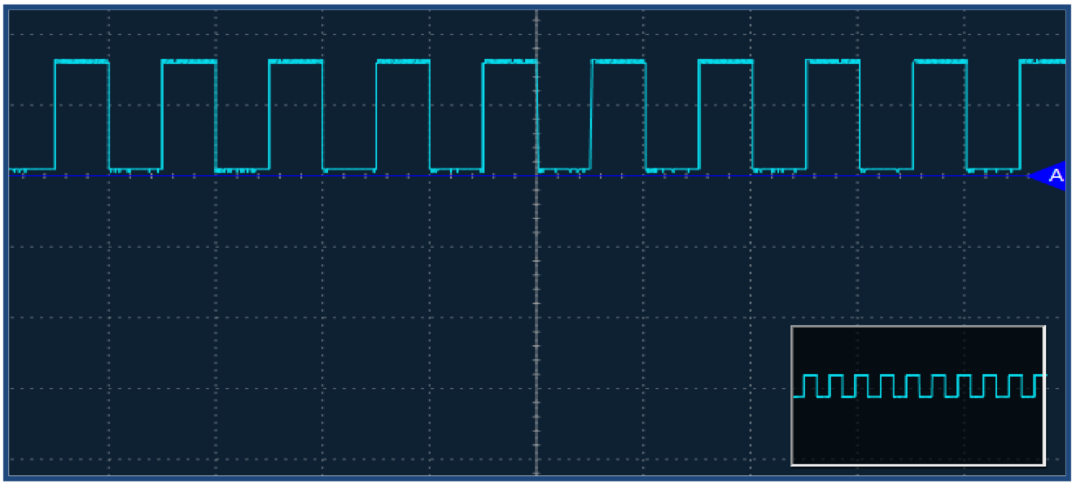
These two measurement methods are mutually exclusive so that only one kind can be chosen at time. The Marking Measurement is more suitable for waveforms. The Cursor Measurement is more suitable for punctual measurement on certain points of the waveform.



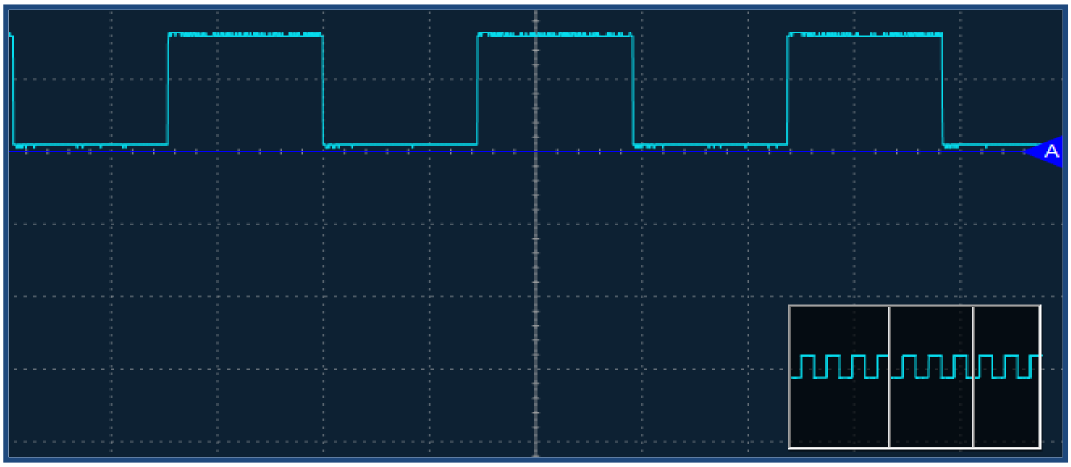


8.2.4.5 X Axis Zoom **button**

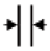
The  button zoom the display area along the X axis for a better observation of the period and frequency of the signal. When this button is clicked, a little window with the full waveform will appear in the lower right corner.



In the display area, select the area to be enlarged by dragging the mouse (the zooming operation is limited only to the X axis). The selected area will cover the entire display interface. In the little windows at the lower right corner, two white lines identify the current visualized area of the waveform.



8.2.4.6 Zoom Out **button**

The  button is enabled only when the waveform has been zoomed in. By clicking on it the visualized waveform can be continuously reduced by clicking on the visualized waveform until it is drawn fully on the screen.

8.2.4.7 Save **button**

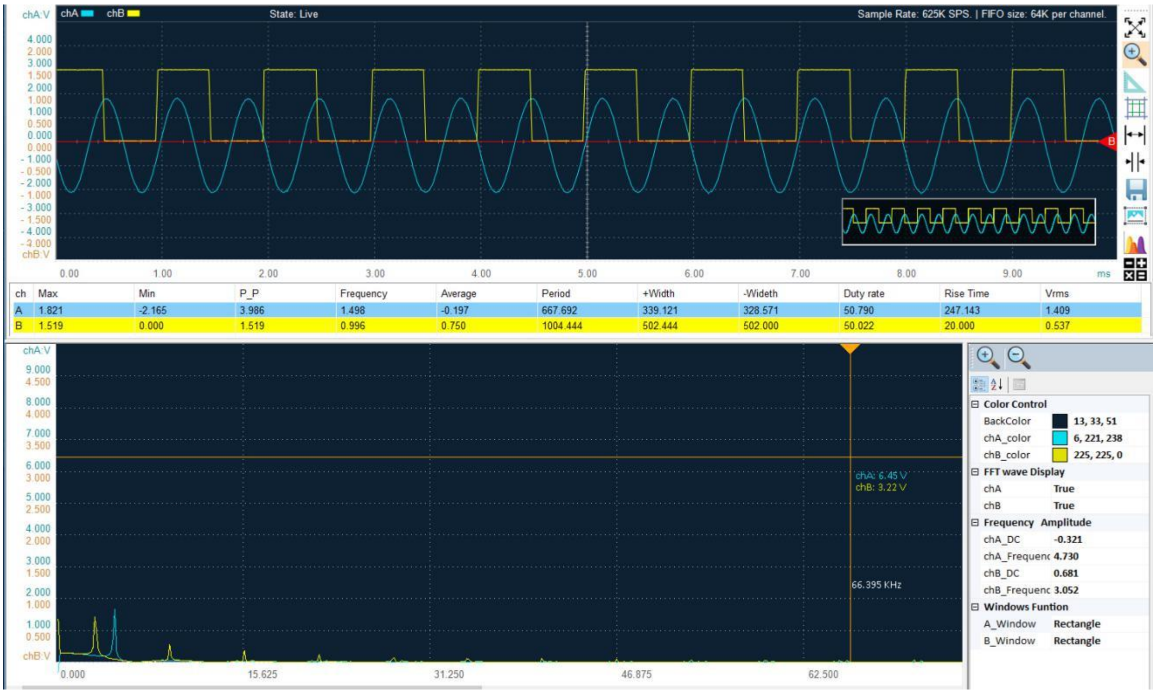
The  button saves the data collected by the oscilloscope in the user's computer in plain text format (.txt). The destination path can be chosen during the process.

8.2.4.8 Screenshot **button**

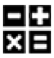
The  button takes a screenshot of the current screen and save it as a picture for later analysis and viewing. You can select the destination path, file name and the file format among the followings: .jpg, .bmp, and .gif (shortcut key (Ctrl + P) - screen-shots).

8.2.4.9 FFT **button**

The  button shows the Fourier Transform of the original measured data coming from the enabled channels, to allow the frequency analysis of the signals.

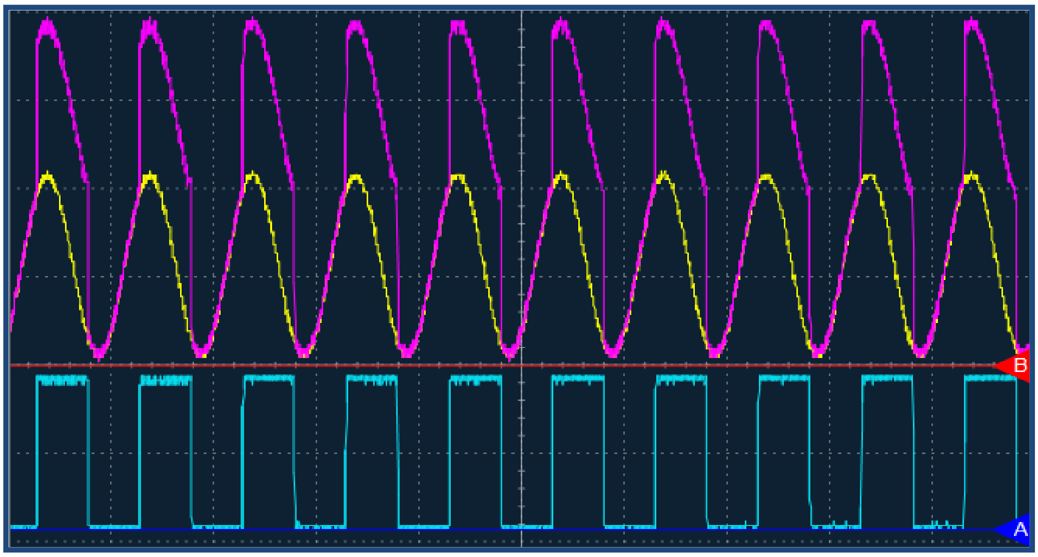


8.2.4.10 Math Operations **button**

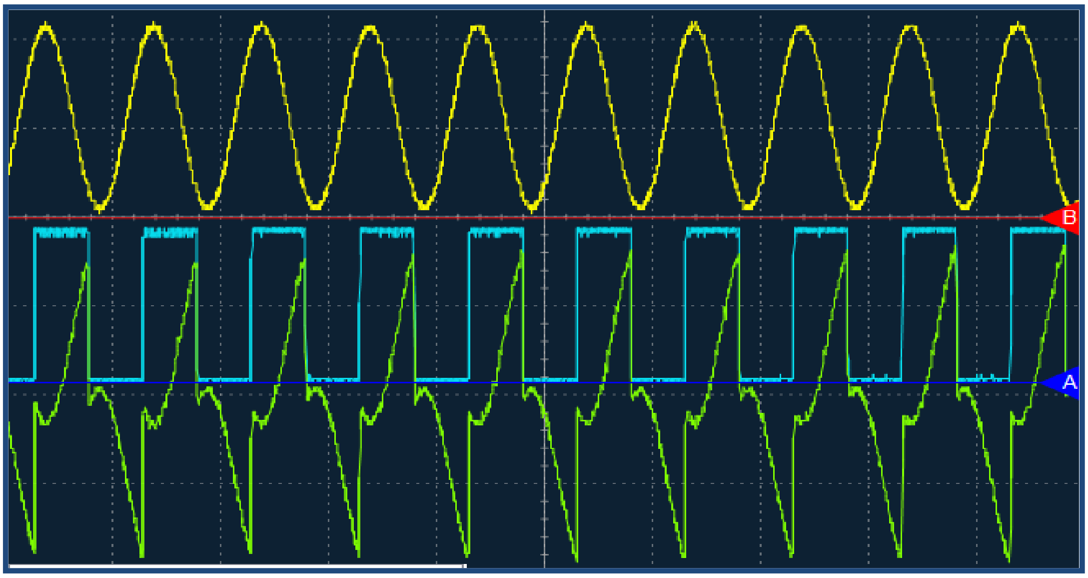
The  button performs mathematical operations between the signals from channel A and channel B like addition, subtraction, multiplication, or XY plotting. Once clicked on this button, you can select the desired operation:

A + B
A - B
A x B
A_B) X_Y)

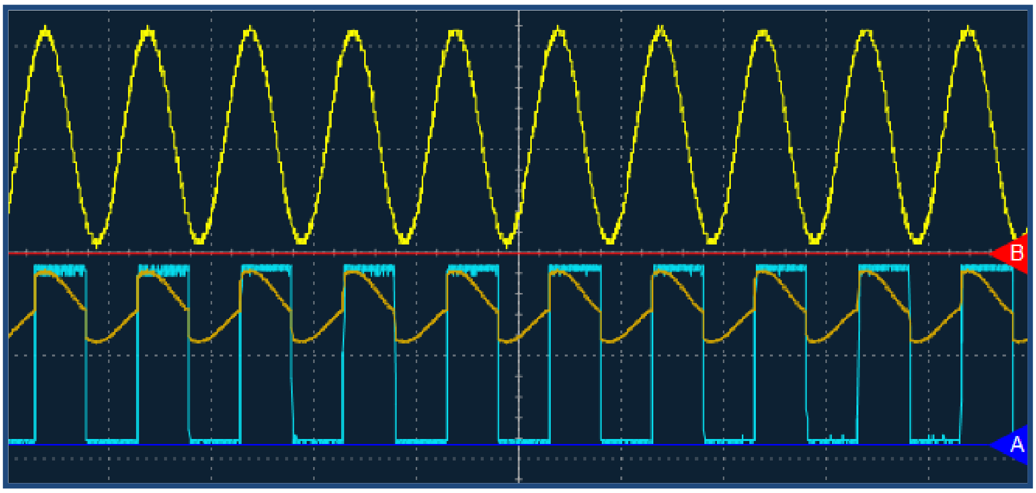
"A+B" means that the channel A waveform is added to the channel B waveform. Selecting this operation, the display area will show both channel A and channel B as stacked waveforms and the waveform resulting from the operation in purple color.



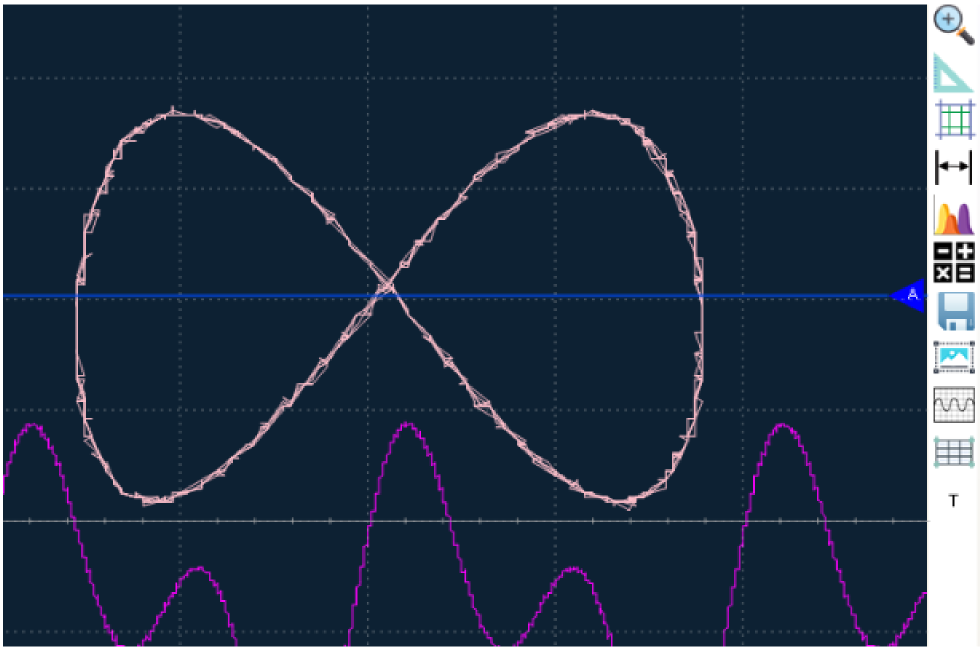
"A-B" is used to realize the subtraction between channel A and channel B signals. In similar way as in the addition both channels' waveforms are displayed together with the result of the subtraction, but this time in green color.

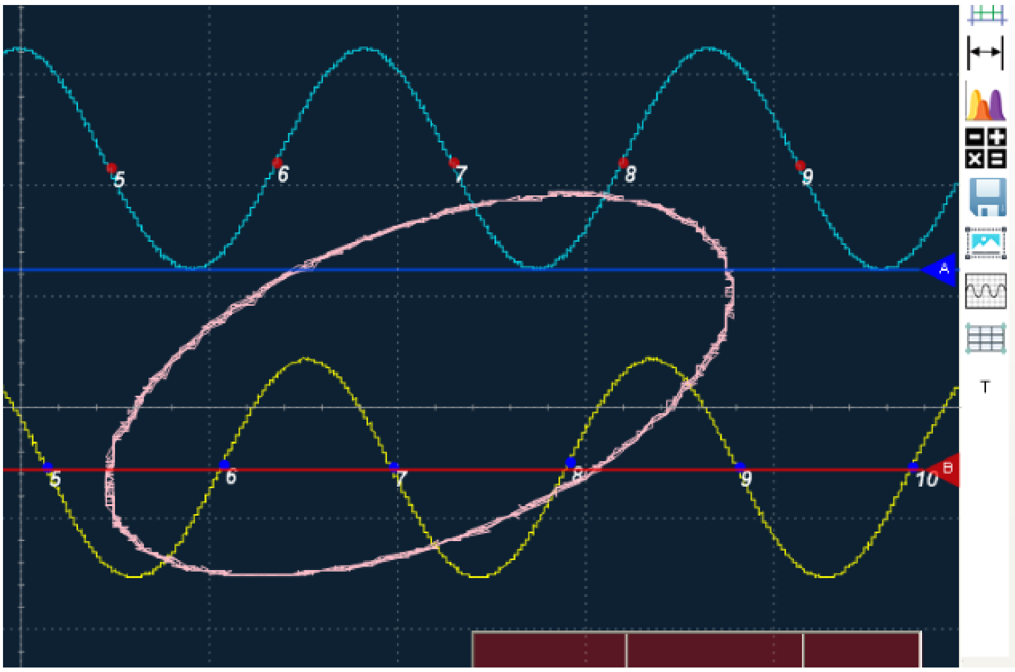


The "AxB" operation is used to multiply channel A and the channel B signals. The result is shown in the orange color.

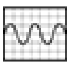


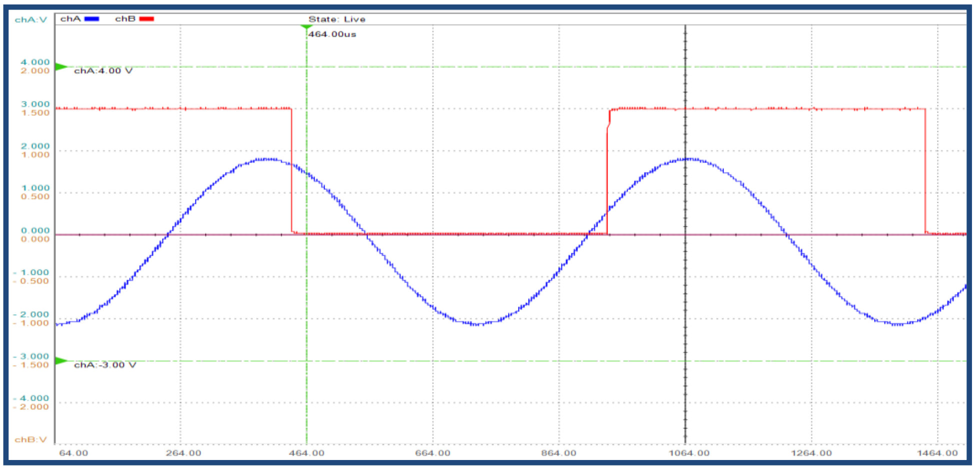
XY Plot or "Lissajous curves" plot. This display mode plots one channel against another on the screen. One channel is plotted on X-axis, the other channel is plotted on Y-axis, together with the information of the measured frequency of each signal. From the resulting curve it is possible to calculate the frequency and phase relation of the signals.



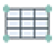


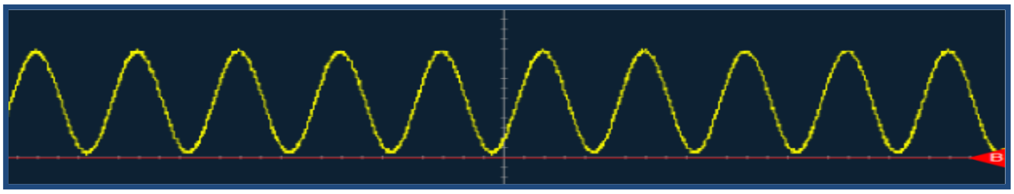
8.2.4.11 Colors Invert **button**

The  button switches the background color from dark to white and the other way around. The dark background is good for long-term observations to alleviate the eye fatigue. The white background is convenient for taking screen shots for making reports or for further image processing.

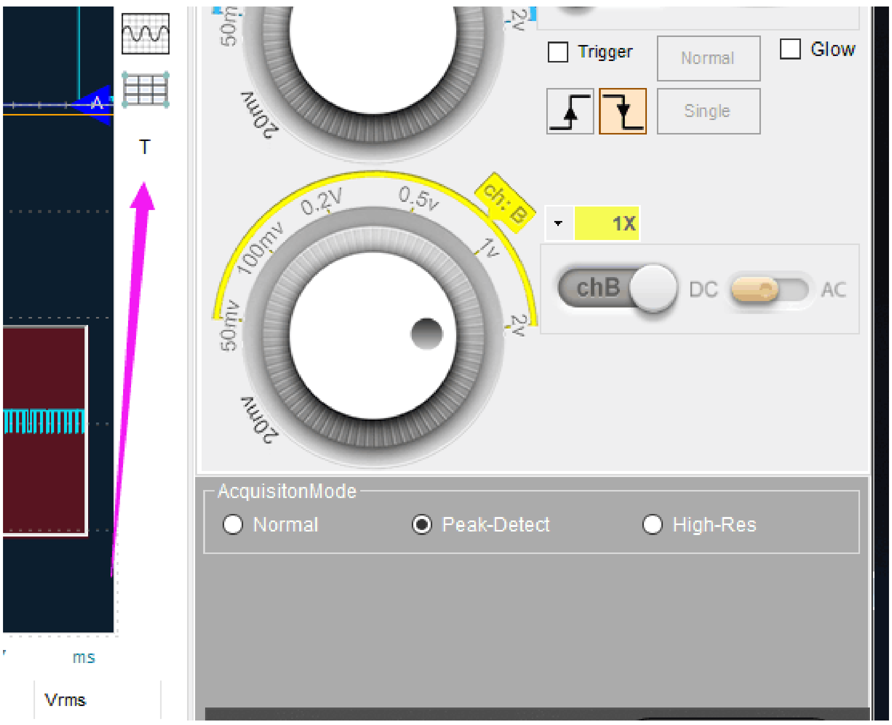


8.2.4.12 Grid Selection **button**

The  button hide or show again the grid displayed in the waveform area.

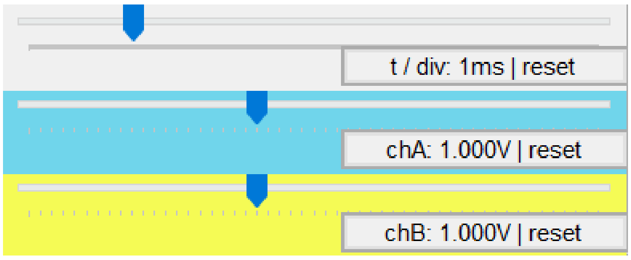


8.2.4.13 Mouse wheel Selection **button " T "**



The " T " button determines which axis will be control by the mouse wheel when the cursor is located in the waveform area. When this button shows "T", we scroll the mouse wheel will give the time axis a fine adjustment to zoom in or out the waveform horizontally. By clicking "T", this button will show "chA", and another clicking will show a "chB", which means the mouse wheel scrolling will lead to a fine adjustment to zoom chA or chB vertically.

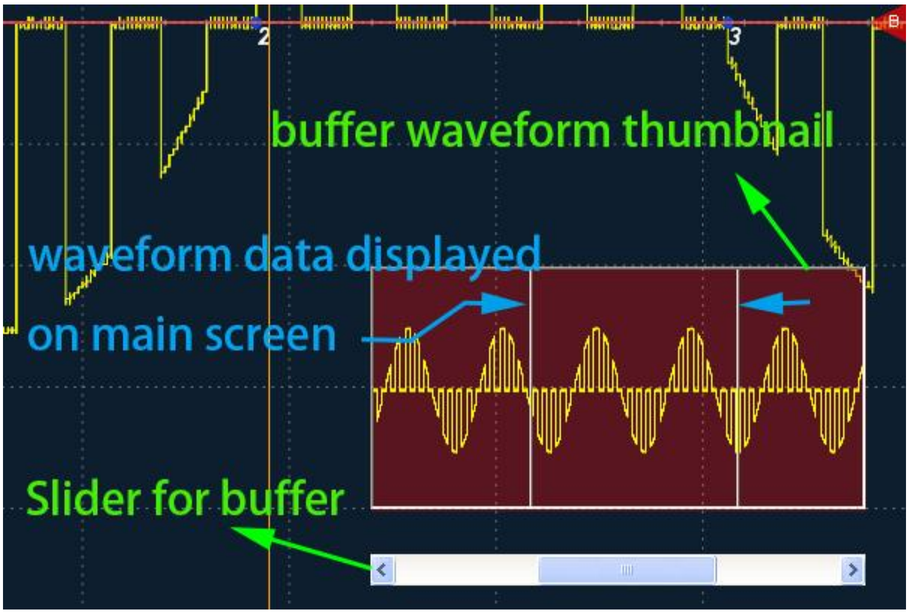
Also, we can do this with three controls in the right lower corner as bellow. However, we may not see these controls when running on a PC with a small screen of screen resolution below 1280*1024.



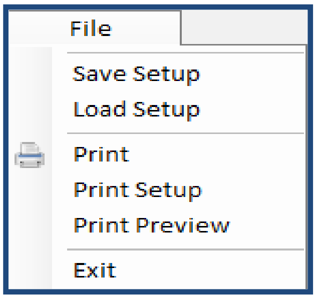
8.2.5 Waveform buffer and left/right shift

When the acquisition is paused, a waveform thumbnail as well as its slider of the whole memory buffer appears in the lower right corner of the waveform area. This slider shows the ratio and the position of the waveform data currently displayed on the screen, related to the size of the entire data buffer. The entire length of the slider represents the entire data buffer. The position and length of the light slider represents the data block displayed in the current drawing area relative to the entire data buffer. The length of the light slider can be used also to understand the ratio between the display data respect the total acquired data. The waveform thumbnail shows the waveform data displayed and the other waveform data in the buffer.

With the mouse you can drag the slider left and right in the entire data buffer, to show new areas of interest. Another way to move within the memory buffer is to use the left and right arrow keys of the keyboard. (Shortcut key(Ctrl + <-) / (Ctrl + ->) - Waveform move between left and right).



8.2.6 Introduction to the Menu



8.2.6.1 File ⟶ Save Setup**:**

When saving you can set the destination path; the file suffix used for the saved file is **.set**. After saving, you can load a saved setup using the menu **File → Load Setup**.
Following are the settings saved with this operation:

No.	Setting
1	Time knob selection
2	Voltage knob selection (for all open channels)
3	Channel on or off status
4	AC/DC coupling status

8.2.6.2 File ⟶ Print **:**

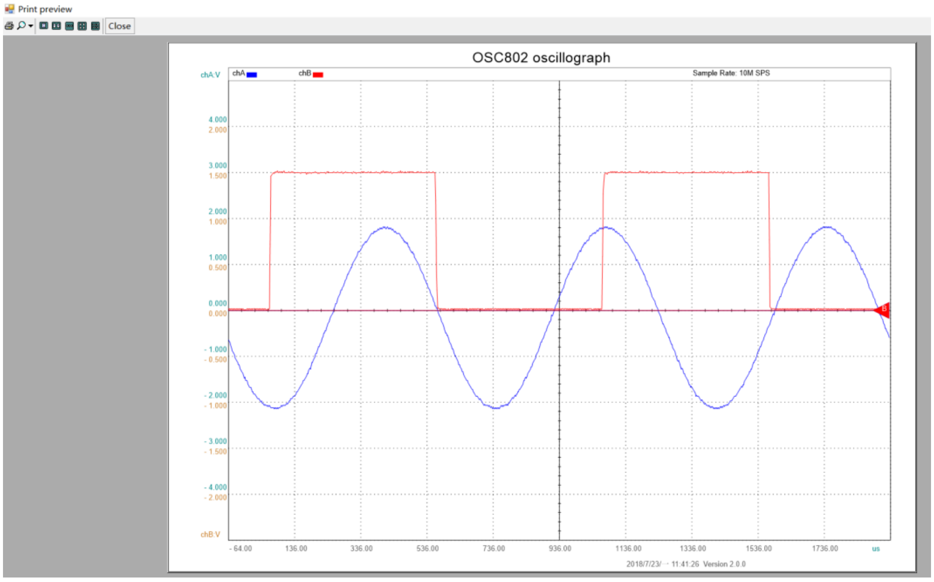
You can select a system printer and print the acquired signal data.

8.2.6.3 File ⟶ Print Setup **:**

You can choose the paper size and print format according your needs.

8.2.6.4 File ⟶ Print Preview **:**

Enter the print preview window and allows you to see what the waveform will look like on the screen before printing a hard copy.



8.2.6.5 File → Exit：

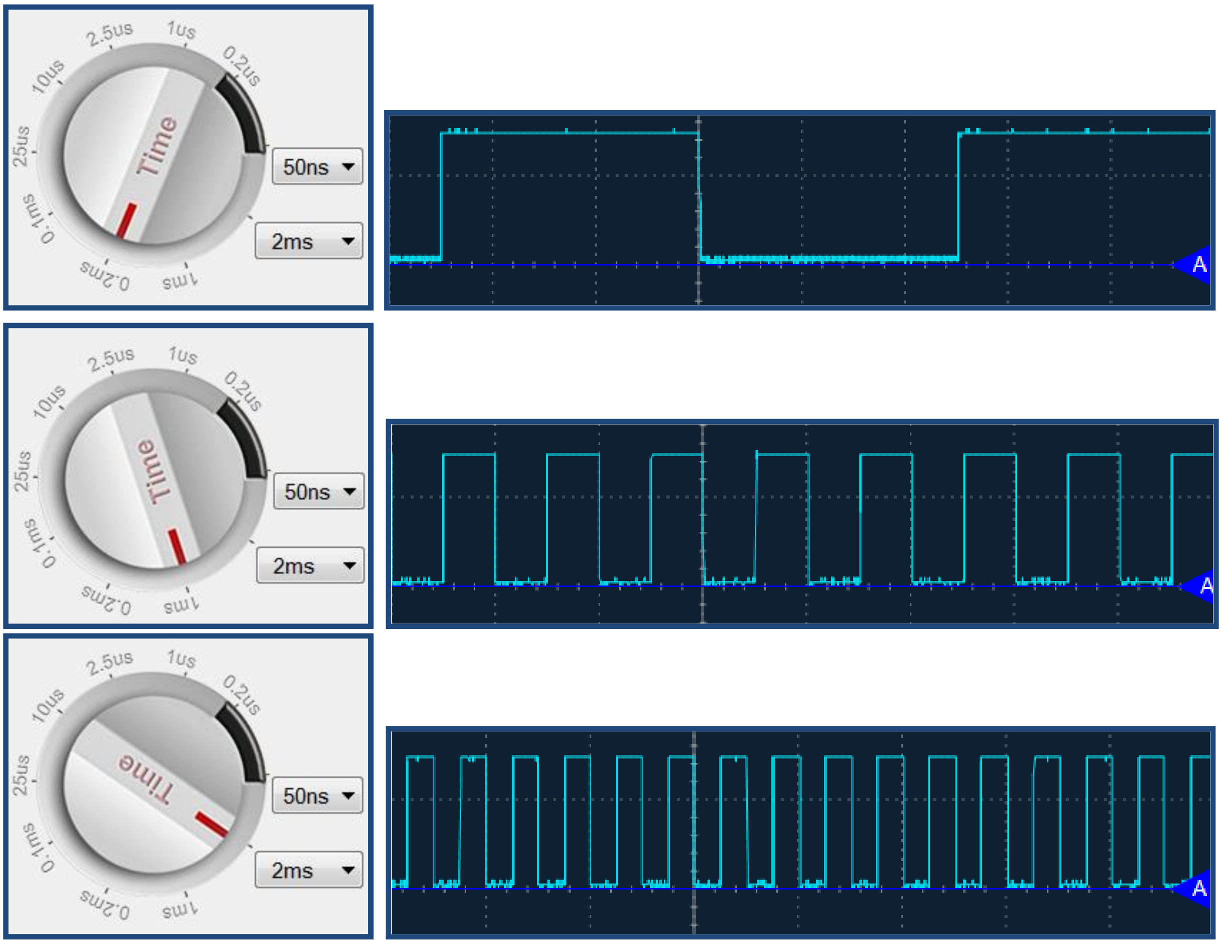
close the software.

8.2.7 Introduction to the knobs

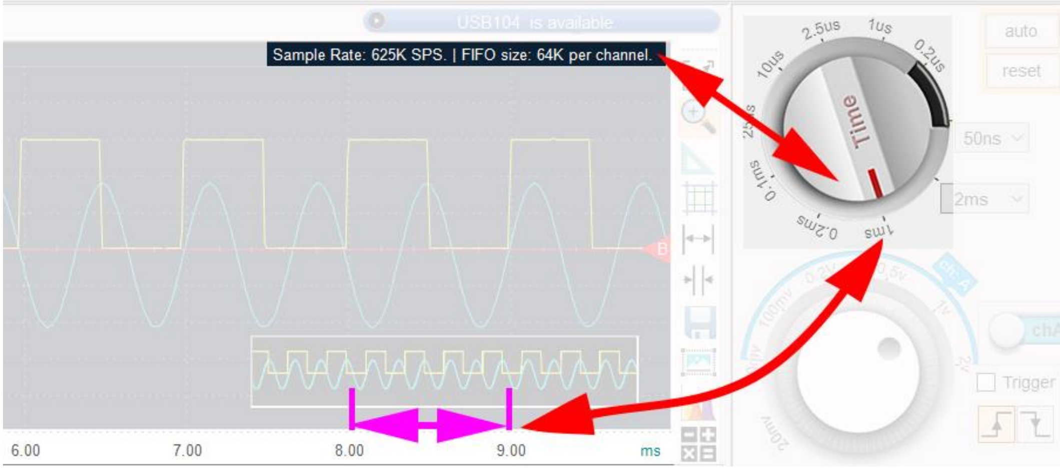
8.2.7.1 Time knob

All the channels of the virtual oscilloscope share the same time settings. The change of the time knob position affects each channel at the same time. The value selected by the time knob represents the time span represented by each horizontal division in the waveform drawing area. In the same way the time span of each horizontal division is the time value indicated by the position of the time knob. Therefore, the time axis coordinates changes according the different positions of the time knob.

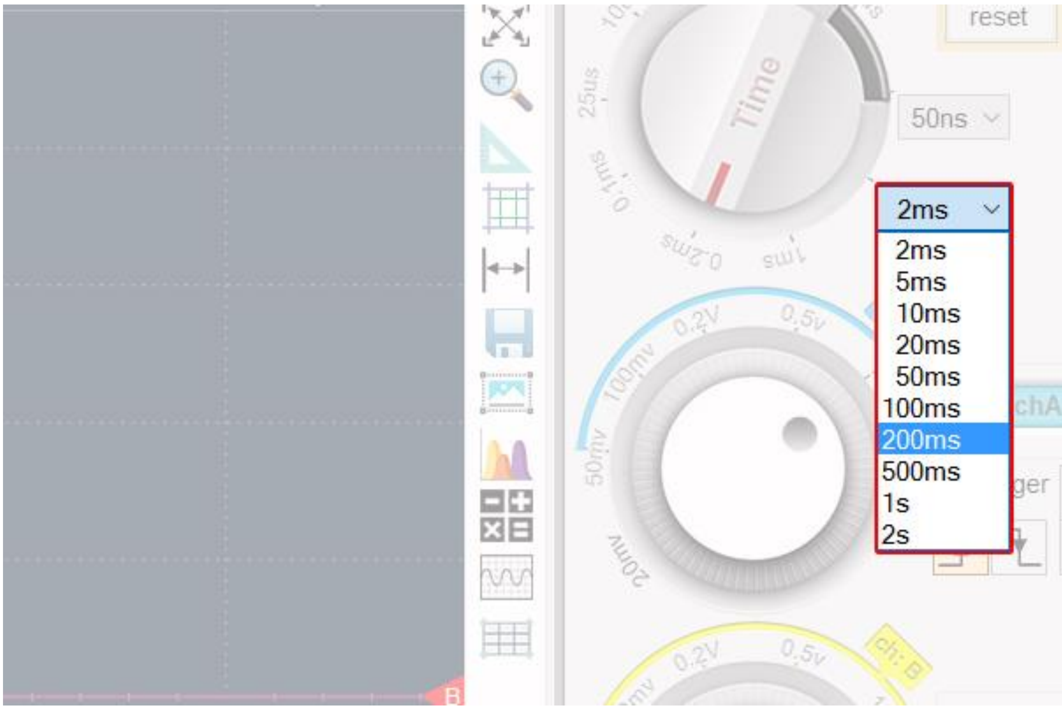
When the time axis is changed by the time knob, the device will select the most appropriate sampling rate, according the current time span and the memory depth on the device.



Sample of display of the same signal at different time scales

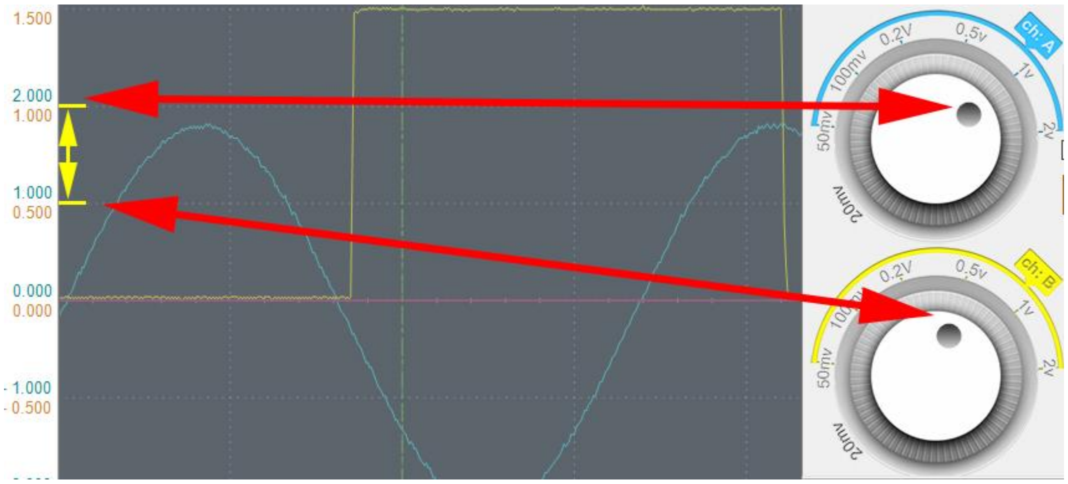


The time knob can be selected within a range from 5/50ns to 2s / division (depending on the model). Since there are 10 divisions on the horizontal axis, the time range of the waveform displayed on the screen vary from 50/500ns to 20s.



8.2.7.2 Voltage Knob

Each channels of this virtual oscilloscope have its own voltage knobs. The value selected by the voltage knob of one channel determines the voltage span of each vertical division in the grid, referred to that channel waveform. The voltage grades differ depending on the model.



Changing the voltage scale with the voltage knob, the ordinate of the waveform in the display area will change accordingly. If the amplitude of the signal has exceeded the upper or lower boundaries of the drawing area, it means that the selected voltage scale is too small, or the amplitude of the signal is greater than the maximum value supported from the device. In this case, a red exclamation mark warning sign will appear on the voltage knob of the corresponding channel.



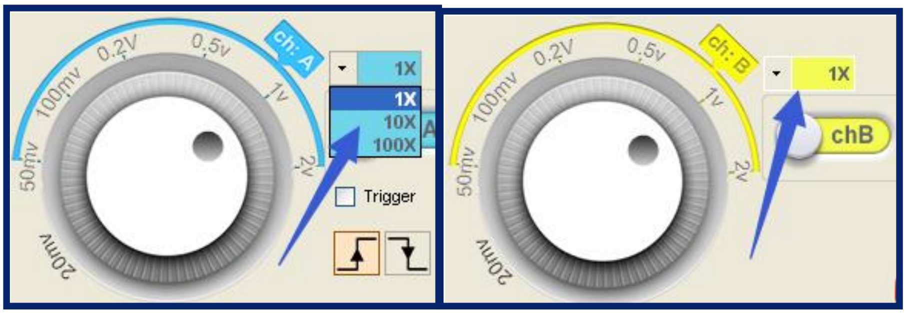
The voltage knob determines also the amplification factor used by the device for the channel, so selecting a smaller voltage value the input range is lower, but the reading accuracy is higher.

8.2.7.3 Probe selection

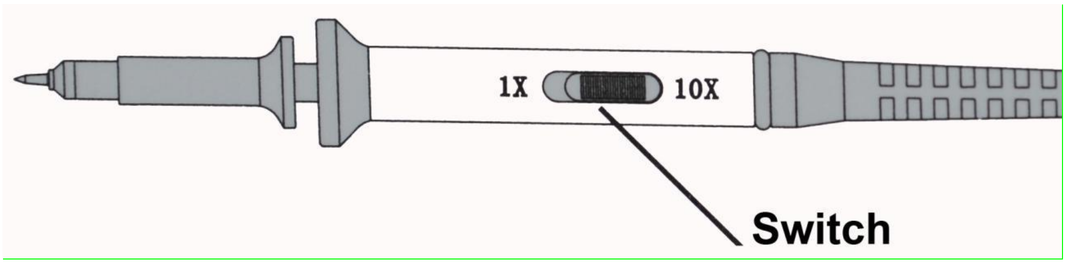
Using different probe divider affects the software's calculated value of the input signal, in particularly the Y-axis of the drawing area, as well as the measured value.

Probe Selection	Description	Input Range
“1X”	Currently using a 1:1 probe	±5V
“10X”	Currently using a 10:1 probe	±50V
“100X”	Currently using a 100:1 probe	±500V

Probe selection setting area in the software:



The corresponding selection switch of the probe:



> **Note**
> The probe selection switch and the software probe selection are mechanical and human operations, and they should be kept on the same values. It is inevitable to forget to keep their settings consistent at some time. This may result in errors on waveforms or measured values.

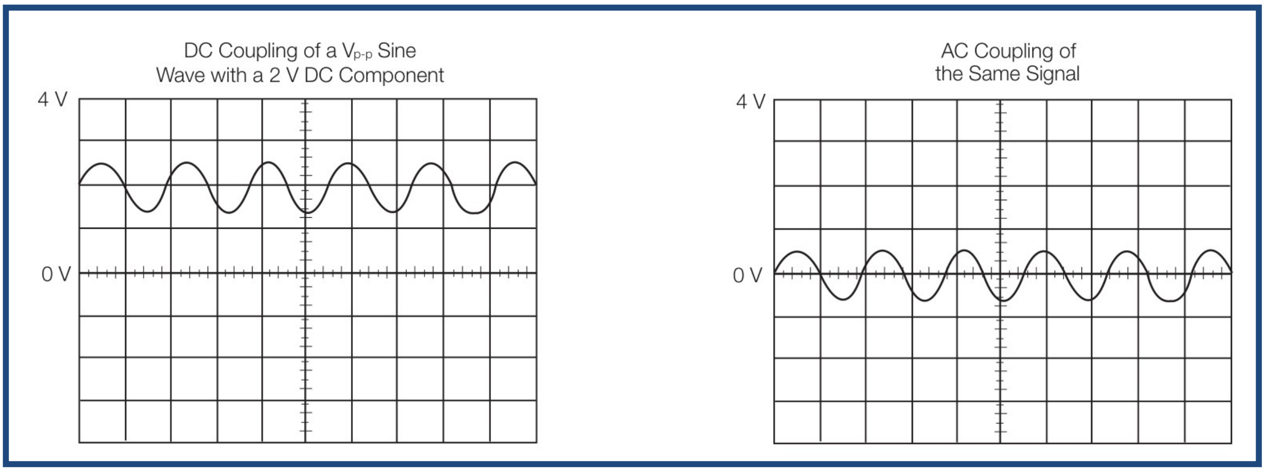
8.2.8 Channel settings

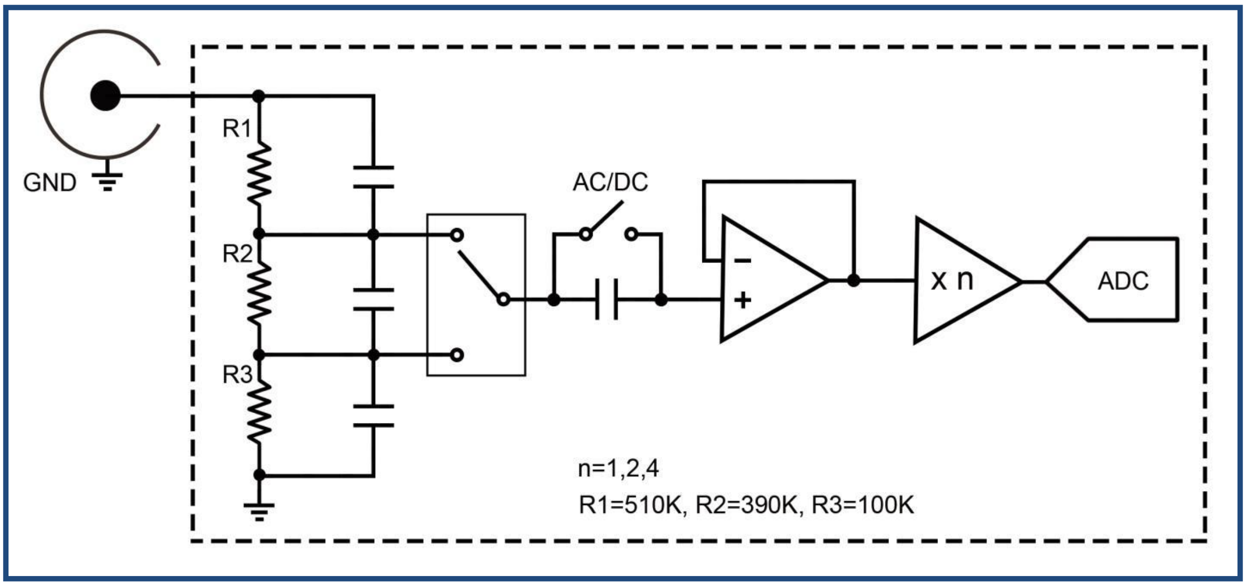
Channel A and channel B can be enabled and disabled with the following switch buttons. When the channel is enabled the button is respectively in cyan or yellow color, while when the channel is disabled the button become gray.



The signal coupling refers to the way the input signal is connected to the oscilloscope. When DC coupling (DC) is selected, the signal enters directly into the oscilloscope. When AC coupling (AC) is selected, the oscilloscope internally isolates the DC component of the measured signal by connecting a 0.1u capacitor in series to the input so that only the AC component of the signal is acquired by the oscilloscope. You can select the Input Coupling (DC or AC) for each channel. The default coupling mode is DC coupling.

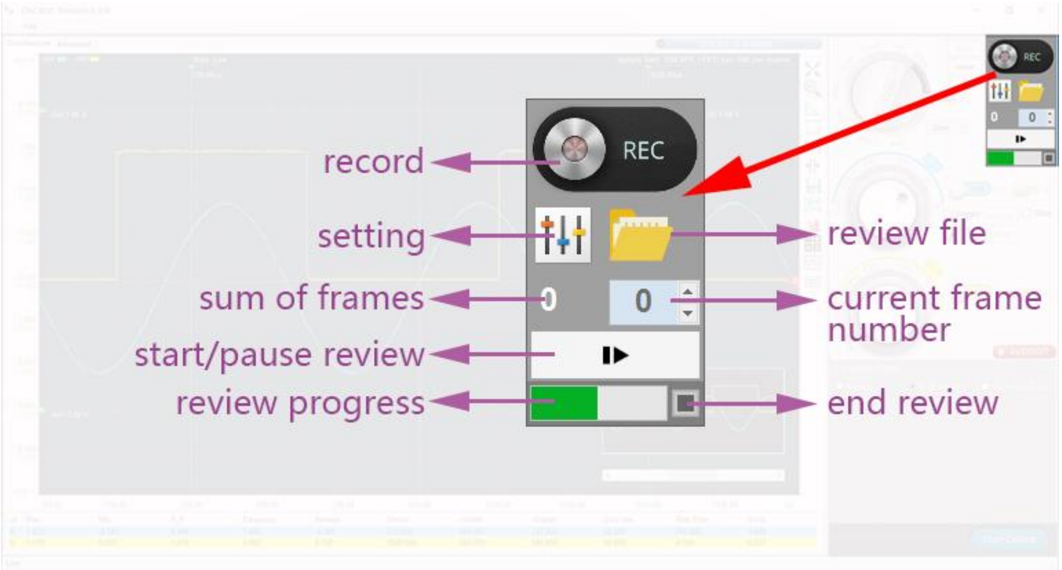




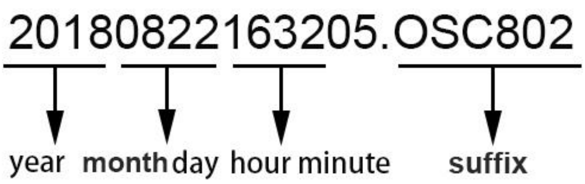


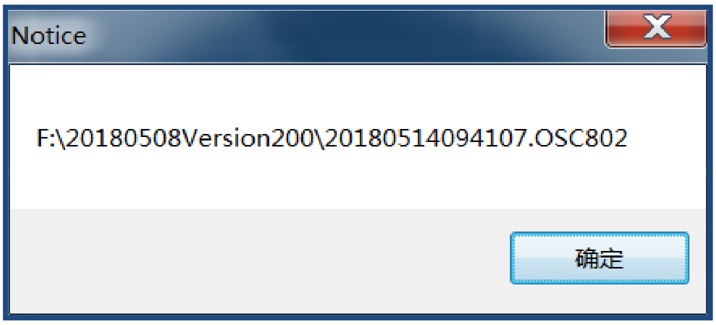
8.2.9 Waveform recording and playback

The waveform recording function is very useful when the acquired signal needs to be recorded and saved as file for further observation or for sharing for off-site analysis.

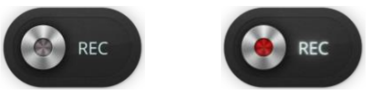


The recording file has its own file format with suffix **.OSCxxx**. The file name is automatically generated as the date and time when the recording is started, and it is saved in the directory where the software is located, after the waveform recording operation is finished. The file name is assigned as following:





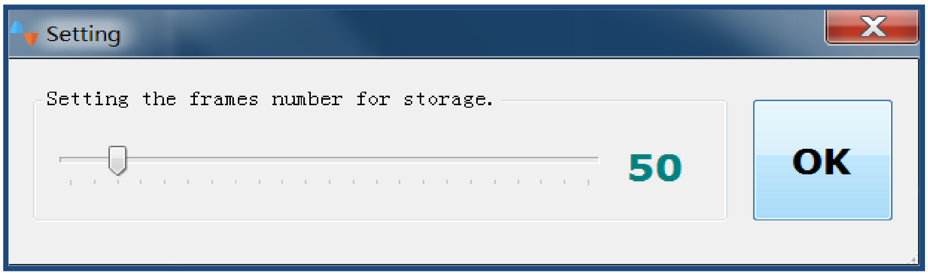
The Recording Button



When the device is not acquiring data in real time, the recording button is grayed out, indicating that the recording is not available. When the device is acquiring data in real time, the recording button is displayed in red, indicating that the input signal can be recorded. During the recording, the red button will keep flashing.

During the recording, not only the waveform but also the oscilloscope settings status is recorded synchronously. During the playback, both device settings and waveform statuses are reproduced synchronously.

 The settings button is used to set the number of frames to be recorded. After clicking on this button, a window will allow you to select the number of frames to be recorded with a slider.

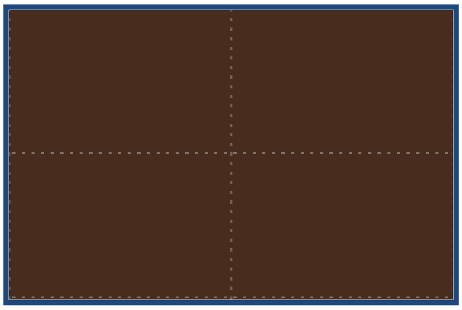


During the playback, the software will suspend the oscilloscope real-time acquisition. This will be resumed at the end of the playback.

In order to distinguish the playback waveforms from the real-time waveforms, the background color for the display area is different. During the real-time acquisition the background color is dark blue; during the playback it is brown (as shown below).



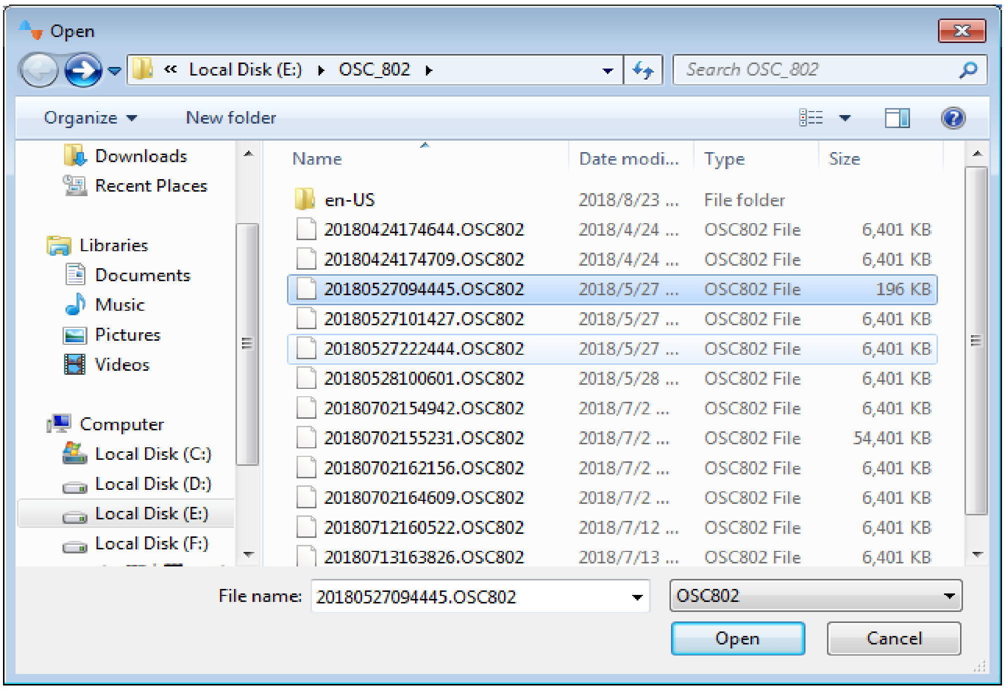
Background during the real-time acquisition



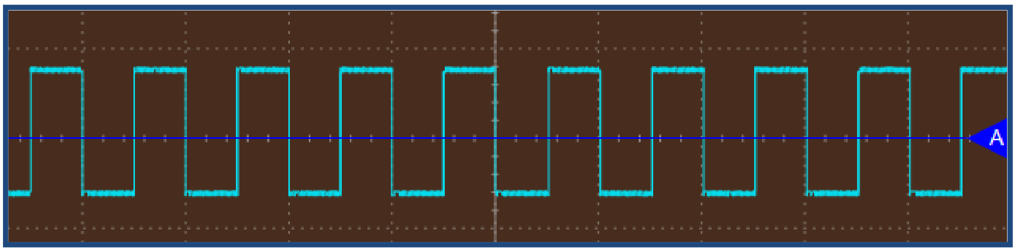
Background during the playback

Waveform playback steps

1. Click on the folder button  to open the file dialog.
2. Search and select the waveform file that you want to playback.



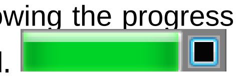
3. Open it to start the playback of the waveform data.



4. The number of waveform frames contained in the current file are displayed as following:



In the above picture the total number of frames is 50, the second number (23) is the number of the current showed frame. You can use the up and down arrows to jump to another frame or you can directly enter the number of the frame to be showed.

5. When all the frames in the file have been played, the background color of the waveform area will turn back to dark blue. The logo showing the progress of playback will also change from gray to green, and the playback will end. 

6. If you need to end the playback, click on the stop button ■. If you need to pause the waveform for observation or processing, click on the pause/play button ▮▶ .

8.2.10 Automatic measurements

During the acquisition the signal statistics are computed automatically in real-time and showed in the measurement area below the waveform display area. These values are displayed

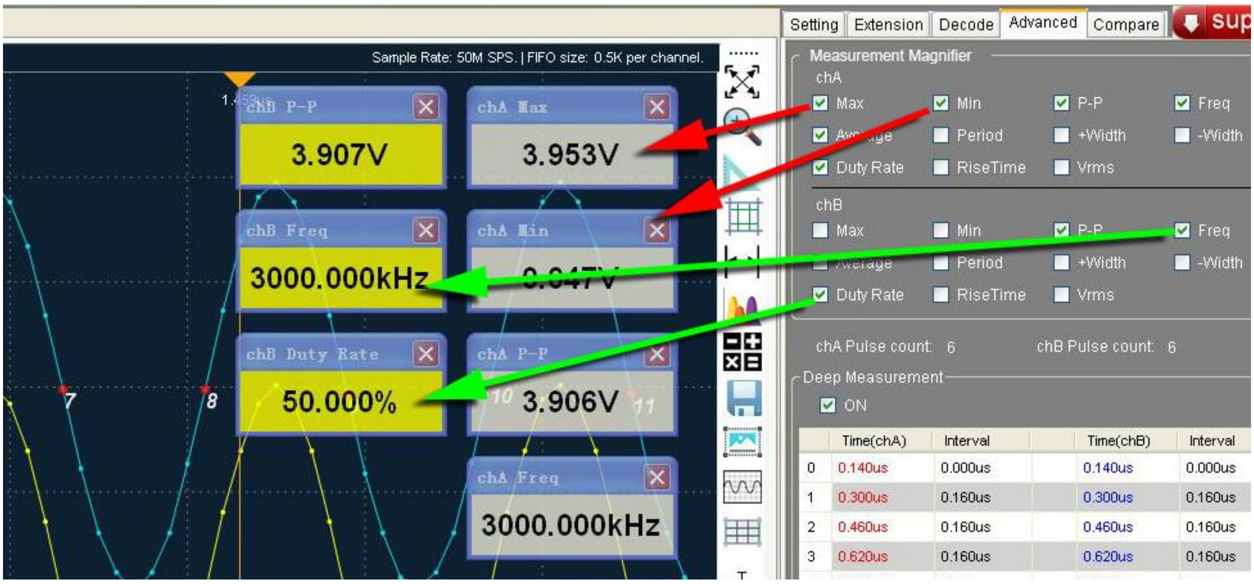
only for the active channels.



Measurement	Description
Max	The highest voltage value of the current channel waveform on the screen, in Volts
Min	The lowest voltage value of the current channel waveform on the screen, in Volts
P-P	Peak to Peak Voltage (Max – Min), in Volts
Frequency	The average frequency of the current channel waveform on the screen, in Kilohertz (KHz).
Average	The average voltage of the current channel waveform on the screen, in Volts.
Period	The signal period, in microseconds (us).
+/-Width	Respectively the Width of a positive pulse at 50% crossings and the Width of the negative pulse at 50% crossings, in microseconds (us).
Duty cycle	Positive pulse width as percentage of period.
Rise Time	The time it takes for the waveform to rise from the 5% position of the peak value to the 95%, in microseconds (us).
Vrms	The root mean square value of the current channel waveform, in Volts.

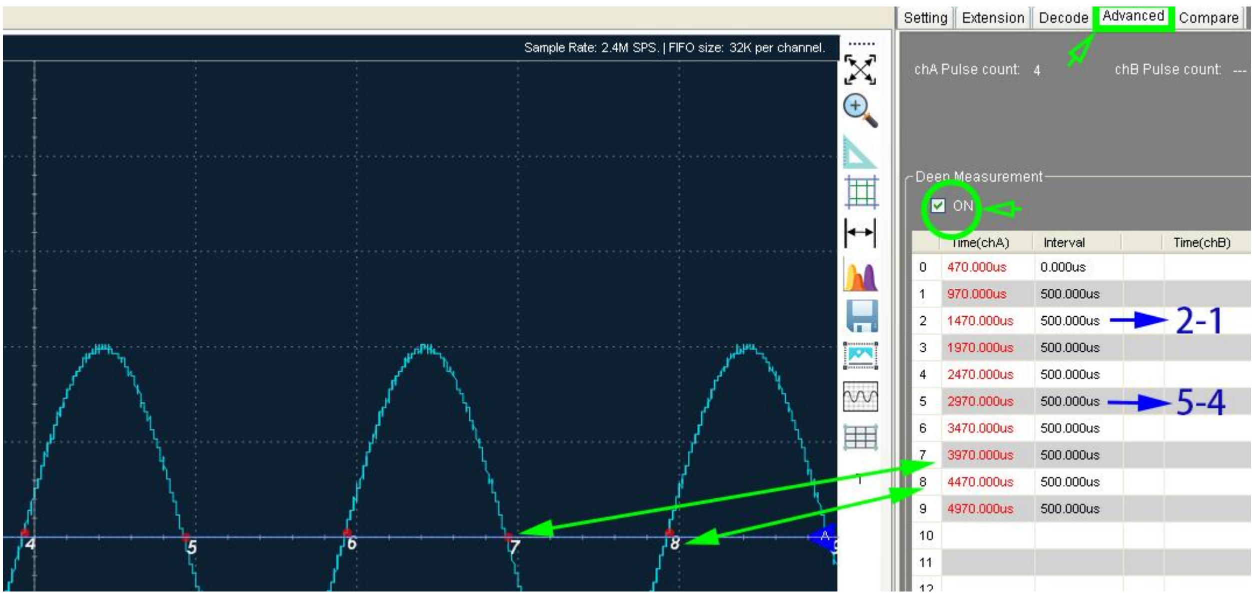
Note
If the waveform of the current channel is displayed on the screen for less than one period or for more than 50 periods, the Period measurement will be displayed as 0 because the measure cannot be performed, but this don't mean that the signal period is actually 0.

8.2.11 Measurement Magnifier



The automatic measurements described in the previous chapter will be shown below the software, and sometimes we need to focus on a few measurements, and hope to be more intuitive and convenient to observe them at any time, we can use this magnifier function. In the Advanced tab on the right, we can choose which measurement to magnify. This function does not conflict with the automatic measurement described in the previous chapter, they can coexist.

8.2.12 Deep measurement



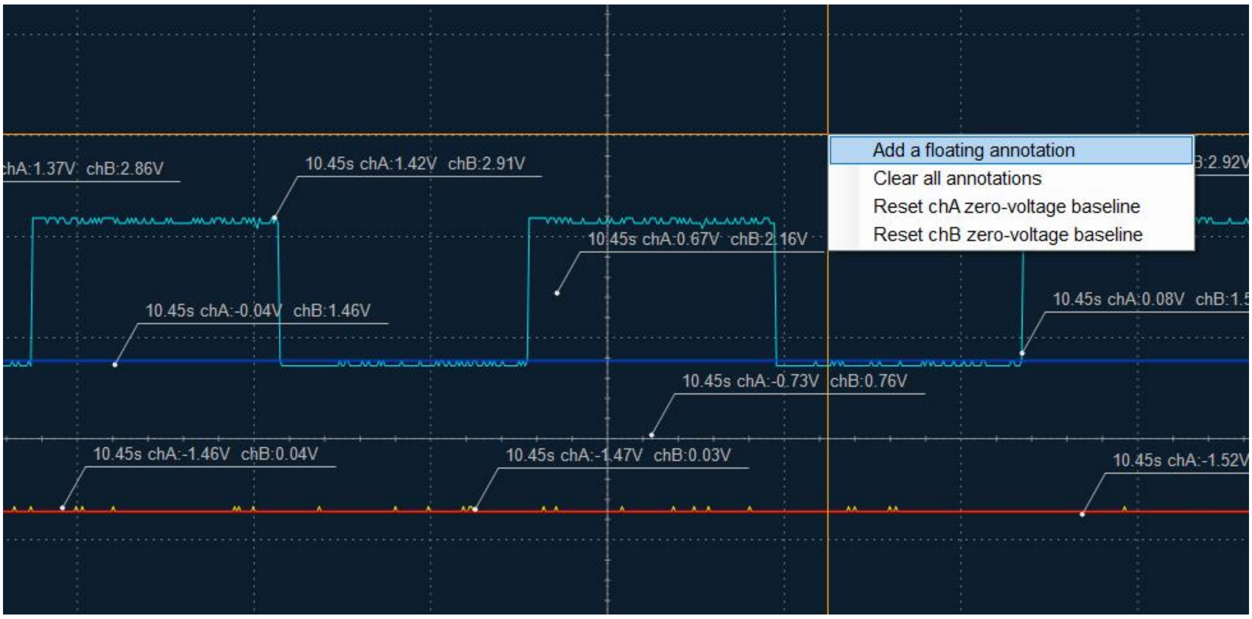
In the Advanced tab on the right side, we can choose to start the deep measurement function, as shown by the green arrows in the figure. When the deep measurement function is turned on, the data waveform displayed will automatically add numbered marker points near the zero-crossing point.

The number of marker points depends on the waveform displayed on the current screen. The numbered marker points are arranged in the table on the right .The time value of the marker points displayed in red as a column, as shown by the long green arrow in the figure.

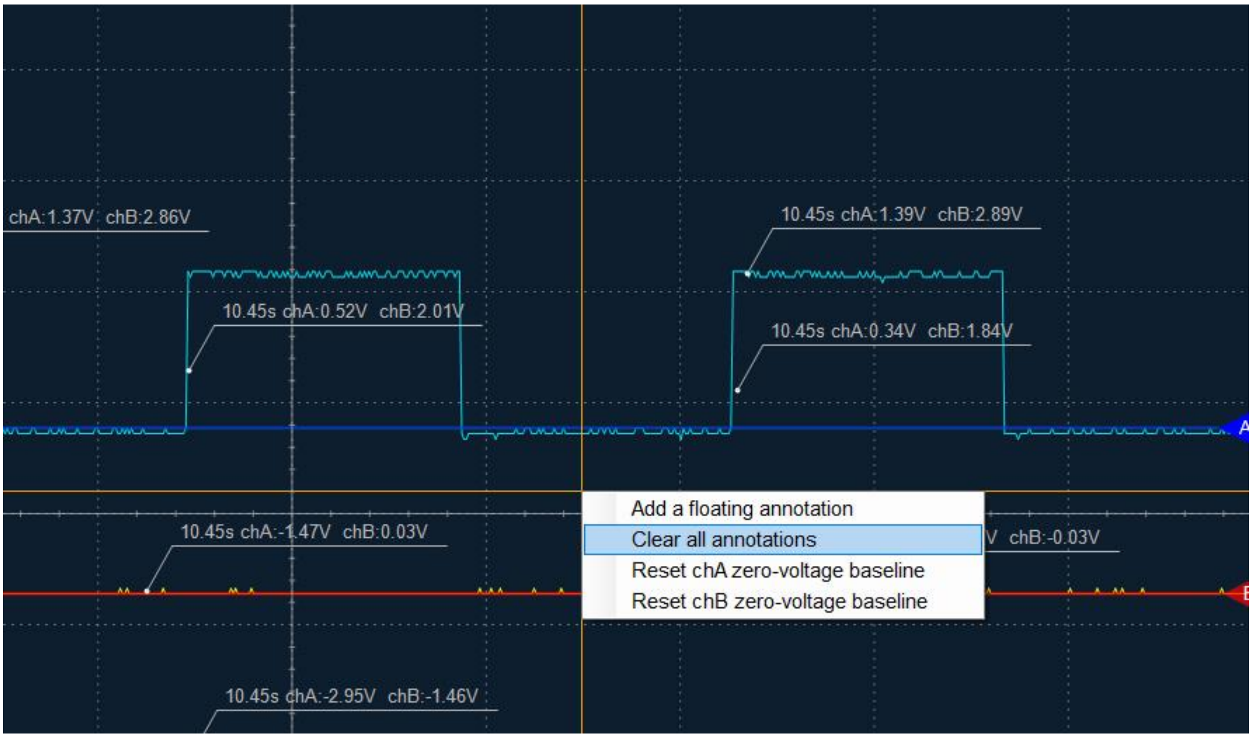
The next column displays the time interval between two adjacent numbered marker points, as shown by the blue arrow. The time interval of each row is obtained by subtracting the time of the current marker points from the previous one.

8.2.13 Annotations

The first item can be found in the right-click menu of waveform display area, and floating data annotation can be added. Data annotation can be dragged to any position in the waveform display area with the mouse, which will display the channel voltage value and the time value of the annotation point. Data annotations can be added and dragged continuously to places of interest, adding up to 10.



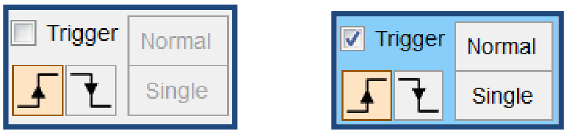
In the second row of the right-click menu, there are options to clear all data annotations, as shown in the following figure:



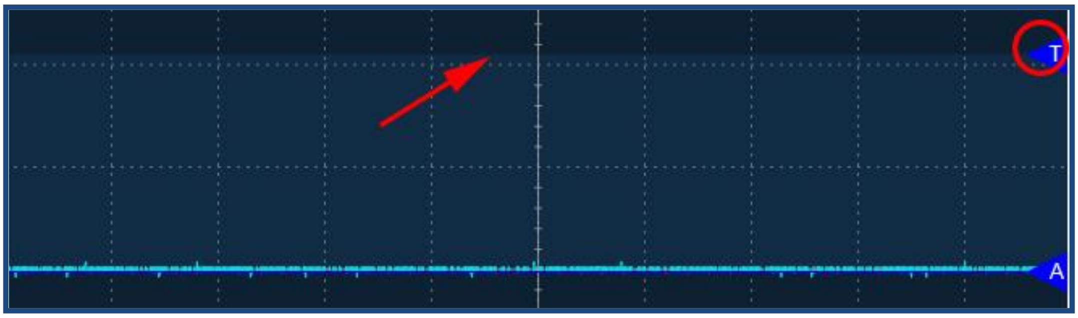
8.2.14 Trigger

The signal triggering in OSCxxx is implemented by the hardware and at all sampling rates except for OSC48xx. OSC48xx use a software trigger mechanism for the lack of CPLD chip support. The trigger can be set to either on a rising edge or on a falling edge, and in either Normal or Single mode.

You can set the trigger in the trigger setting window and enable the trigger by selecting the checkbox.

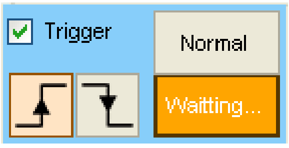


The trigger function can be used only on channel A, so when you need to apply the trigger to a signal, the signal should be connected to channel A. When the trigger is enabled, a triangle with ‘T’ inside will appear on the right of the waveform display area to allow the trigger level setting by dragging this blue triangle up and down with the mouse.



The trigger level is combined with the selected rising or falling edge to define the trigger condition. Considering as example the Normal Trigger with rising edge, the trigger condition is met when the input voltage of channel A goes from low to high respect to the voltage value set by the trigger level. When the trigger condition is met, the screen will display the entire waveform before and after the trigger condition, keeping it until the trigger function is checked or the next trigger occurs.

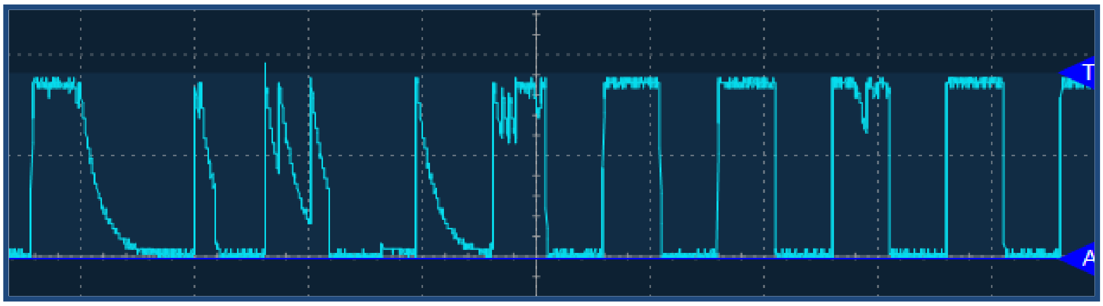
The Single trigger can easily capture accidental events, such as glitches with sudden changes in waveform amplitude. You can set the trigger level just above the maximum value of the normal signal, then click the **Single** button and wait for the trigger event to occur. When the signal fluctuates beyond the trigger level, the oscilloscope automatically records the waveform for a period before and after the trigger, and show on the software display area as shown in the following figure:





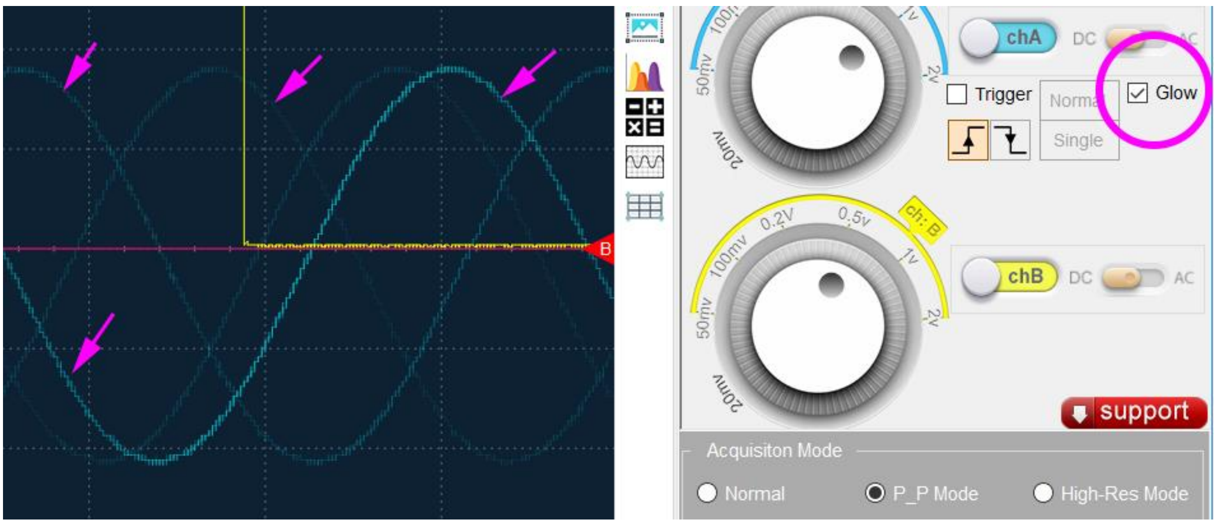
When the signal fluctuation is frequent, if you want to continuously capture and show the signal when matching the trigger criteria, then you need to use the Normal trigger with the **Normal** button. During trigger scanning, the **Stop** button with appear for stopping the operation. Some model device may not have this normal trigger feature.

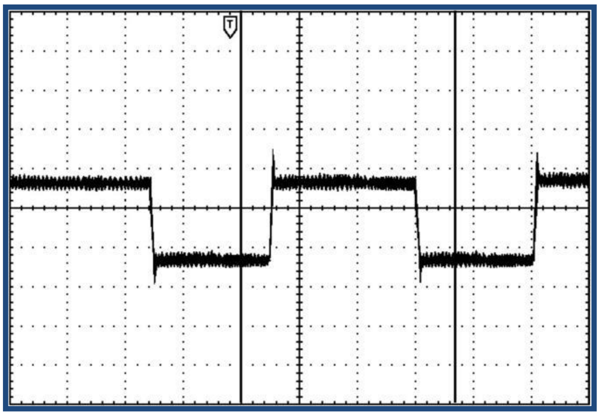


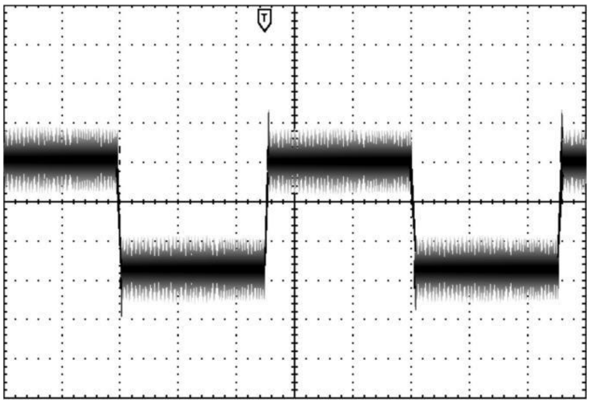


8.2.15 Waveforms persistence

The waveforms persistence effect superimposes on the screen the data acquired in successive times and allow the observation of the spatial concentration of the waveform energy. When the **Glow** checkbox is set, the oscilloscope continues to acquire and display new data, but do not erase the previous collected data. The waveform parts with higher occurrence will have higher brightness; parts with fewer occurrences will appear less bright. The waveforms persistence superimposition has a significance as a statistical measurement, since it can show in intuitive way the distribution of noise on the time and space. This makes it suitable for the preliminary analysis of random noise.





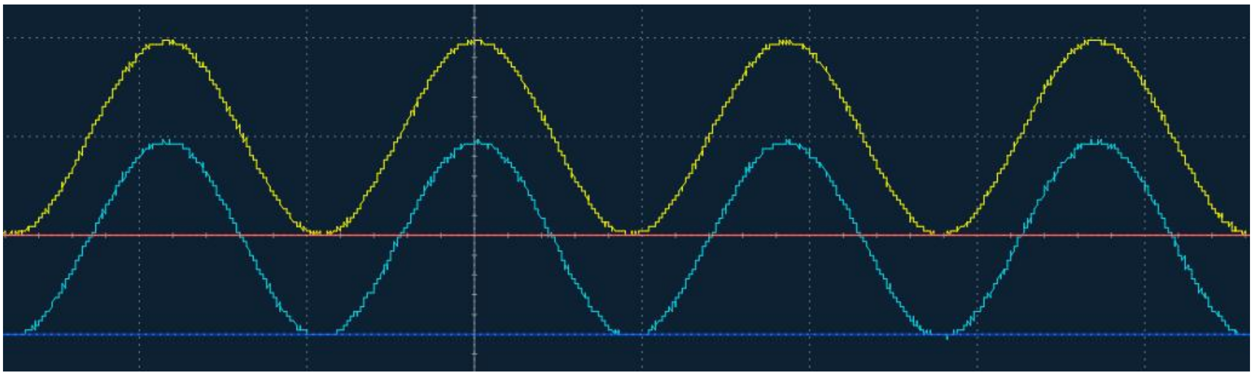


8.2.16 Acquisition Modes



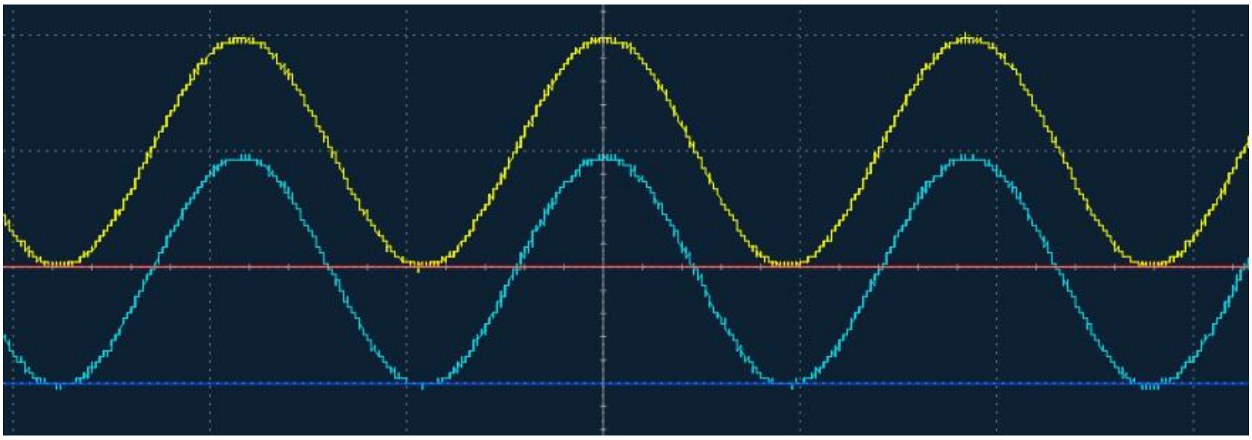
Normal mode:

This is the most common sampling mode. The oscilloscope store and display the samples according to the sampling rate.



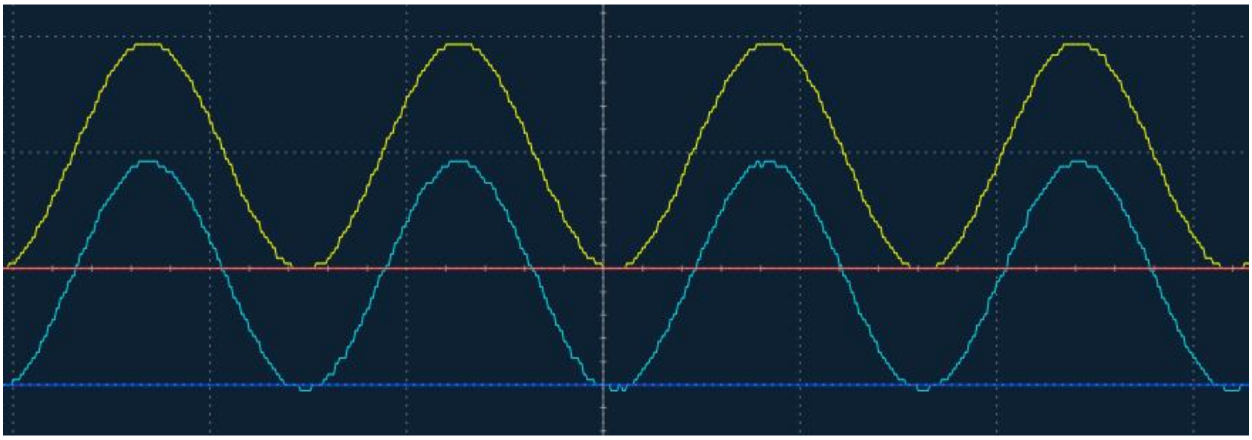
Peak Detect mode:

The oscilloscope samples always at the maximum sampling rate to find the maximum and minimum values within the time interval for each sample, and then it displays the maximum and minimum values on the waveform curve for each sample position.



Peak Detect mode is best used for detecting glitches, viewing very narrow pulses or measures the amplitude range of the noise. For example, if the actual sampling interval of the oscilloscope is 2ms for one sample, the oscilloscope internally will use the maximum sampling rate and will collect / show 2 values every 2ms. These 2 values are the maximum and minimum values among n data points sampled within the interval of 2ms.

High-Resolution mode:



The High-Resolution sampling mode is an oversampling method that averages multiple adjacent samples to produce an averaged sample. This mode significantly reduces random noise and it is suitable for non-repeating waveforms and single-shot waveforms. Compared to the Peak Detect mode, the High-Resolution mode applies low-pass filtering to the signal, which cut out high-speed glitches.

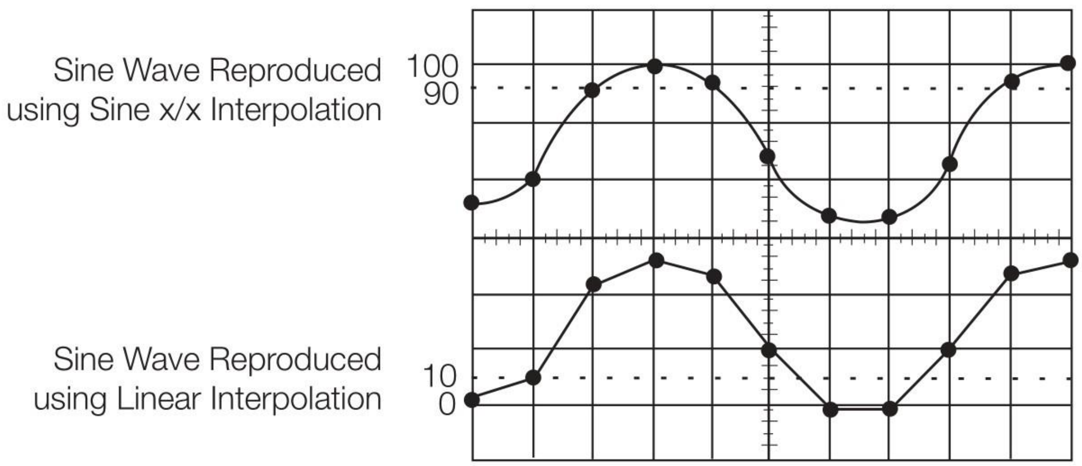
> **Note**
> For displays with low resolution since the display area is too small, the software will move the mode settings window to the Advanced tab.

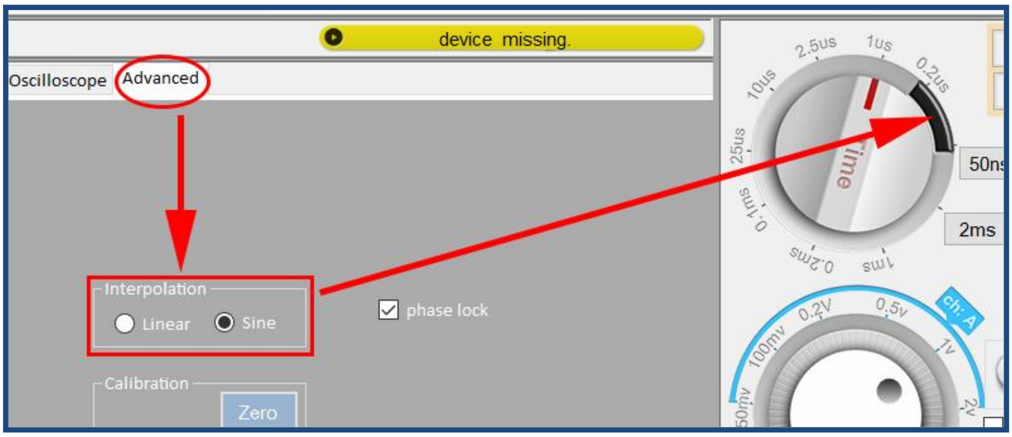
8.2.17 Sine / Linear Interpolation

The samples interpolation consists in filling the gaps between the ADC samples by inserting calculated values according to a specific algorithm, so to improve the visualization of the signal details.

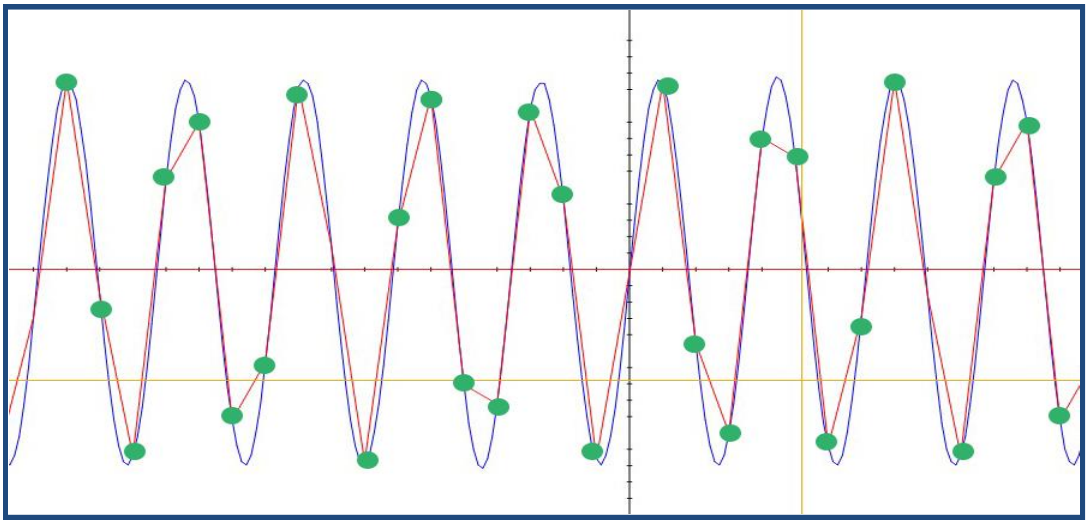
The highest real-time sampling rate of OSCxxx is different from each other. The default interpolation algorithm is performed with sine function 4x. For example, a device with 80MSa/s per channel, for smooth signals, it corresponds to a 320MSa/s of sampling rate.

Another available interpolation algorithm is the linear interpolation, a simple and light method which calculates the interpolated values with the linear interpolation among adjacent samples.





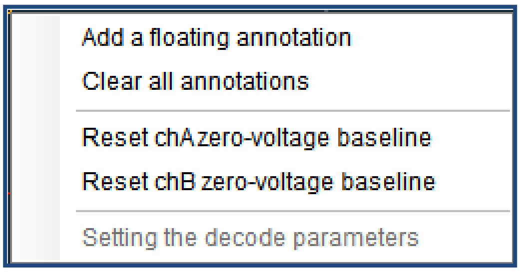
On **Advanced** tab, you can choose among **Linear** or **Sine** interpolation algorithm. The selected algorithm will use the time slots (0.2us and 50ns) in the black sector on the time knob.



The green dots in the above figure are the actual ADC samples, the red curve is the waveform curve generated by the linear interpolation algorithm; the blue curve is the curve generated by the sine interpolation 4x.

8.2.17 Right-click mouse Menus

In the waveform display area, click the right mouse button and the following menu will appear.



8.2.17.1 “Add a floating annotation”

Please refer to 8.2.13.

8.2.17.2 “Clear all annotations”

Please refer to 8.2.13.

8.2.17.3 “Reset chA zero-voltage baseline”

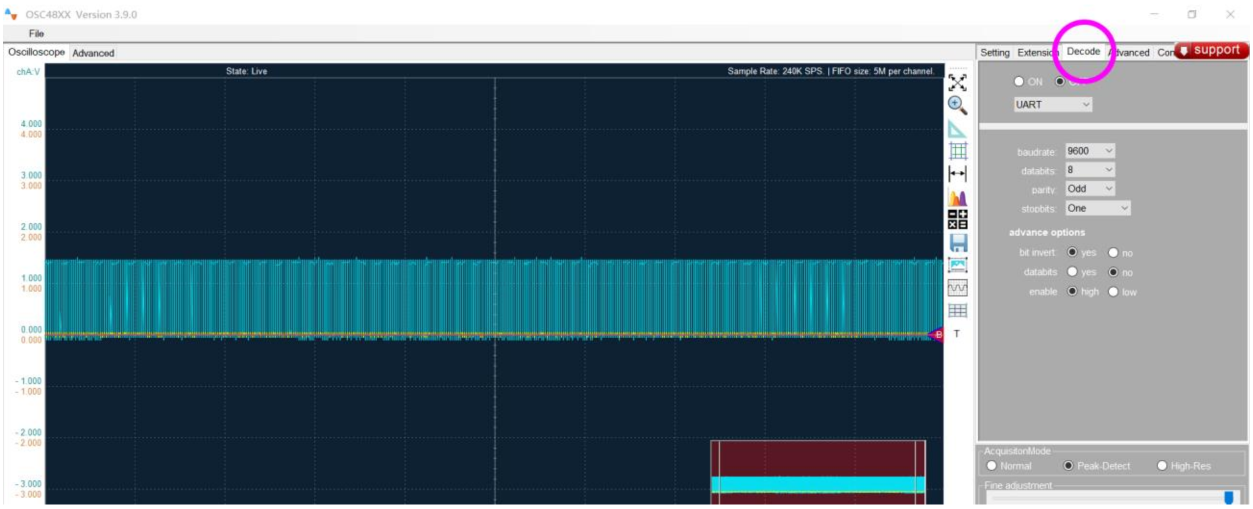
Restore the A channel baseline to the default position. (The default position is the middle position of the Y axis of the waveform display area.)

8.2.17.4 “Reset chB zero-voltage baseline”

Restore the B channel baseline to the default position.

8.2.18 Decode and Setting the decode parameters

Only several model devices support this feature. If you cannot find this feature in your software, it is not available for your device model. Usually, we may find this decoding feature in a “Decode” tab panel on the right.

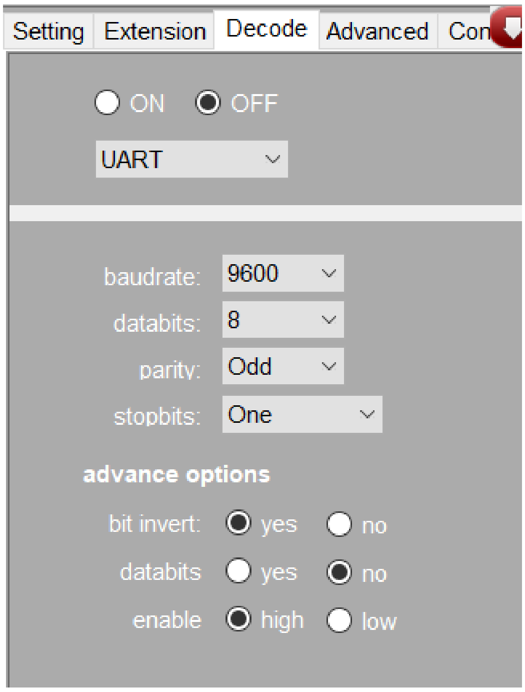


After using the trigger capture communication signal, the oscilloscope software enters the decode mode by selecting the corresponding communication protocol, such as “UART” or “IIC”.

Clicking on the protocol menu item, “On” appears in front of the menu item, indicating that the communication protocol is used for decoding. Clicking “OFF” will terminate the decoding.

After the communication protocol is selected, click the right mouse button in the waveform display area. The “Setting the decode parameters” option in the right-click menu will be activated and changed to the usable state. Click “Setting the decode parameters” to pop up the protocol parameter setting window.

Usually, the software will display this setting window actively when the selected protocol is selected for the first time to remind the user to complete the parameter setting. Then, during the use, you can also use the options in the right mouse button menu to call out this window for parameter adjustment.



Different settings, the setting items appear in the protocol parameter setting window are different; the setting items of "advance options" are special and need to be changed according to specific conditions.

8.2.18.1 “bit invert”

Whether the data bit is processed by "bitwise inversion".

For example: 0x01, 8-bit binary is: 0000 0001.

bit invert Yes, the result is: 1111 1110 (bitwise inversion).

bit invert No， the result is: 0000 0001 (Normal, no inverted).

8.2.18.2 “databits invert”

The order in which each frame of data is sent is from the high bit or from the low bit.

For example: 0x01, 8-binary digits: 0000 0001(The leftmost 0 is the high position, and the rightmost 1 is the low position)

databits invert yes, the result is: 1000 0000(send from low position)

databits invert No, the result is: 0000 0001(send from high position)

8.2.18.3 “enable voltage”

When there is a communication data signal, whether the data signal is high level or low level.

(if IO port defaults to low level when no data is sent, the data is high level when sending data; then you should choose "enable voltage high"). **For example: RS232.**

(if IO port defaults to high level when no data is sent, the data is low level when sending data; then you should choose "enable voltage low"). **For example: TTL.**

8.2.18.4 Failure or Error

Protocol parsing failure or error may be caused by the following reasons:

1. Protocol parsing parameter setting error;

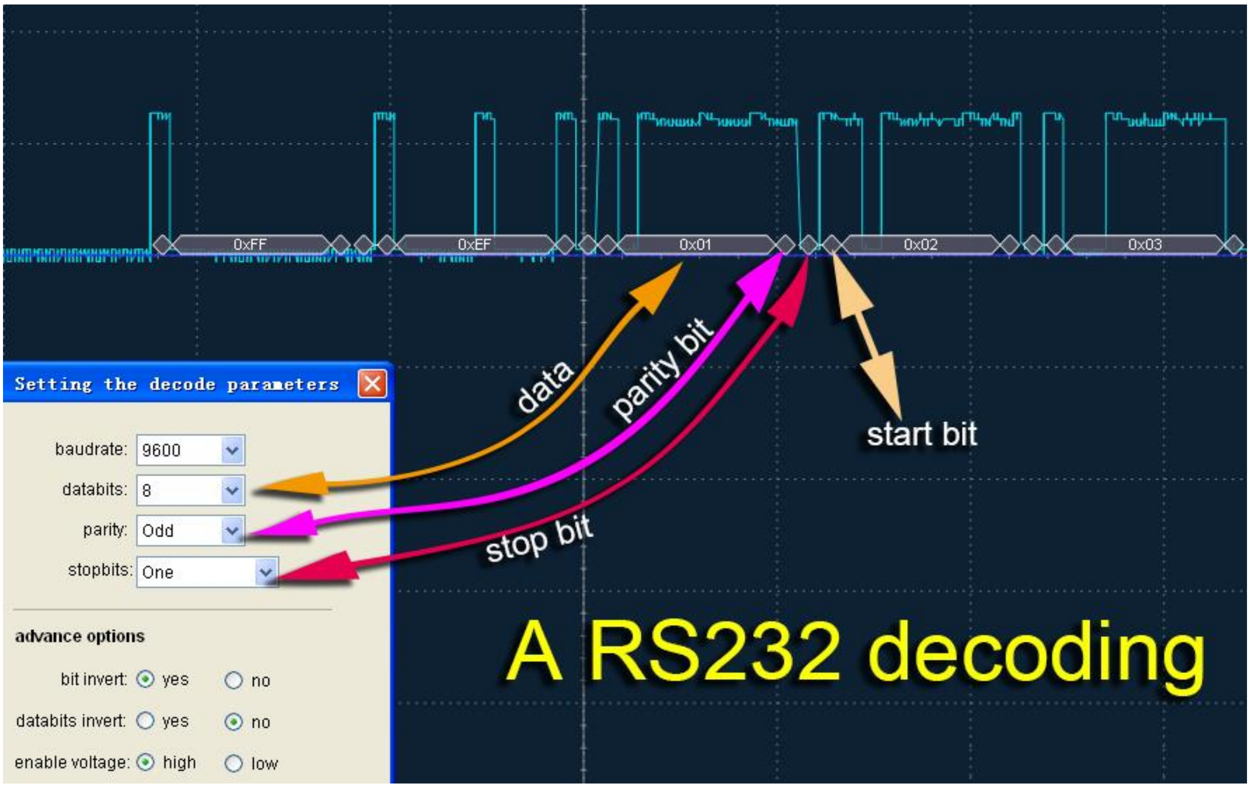
2. In the screen display area, the periodic waveforms are too dense to calculate the interval time correctly.

3. In the screen display area, the periodic waveform is too sparse. There is not a complete frame of data in the display area.

9.2.15.5 Examples

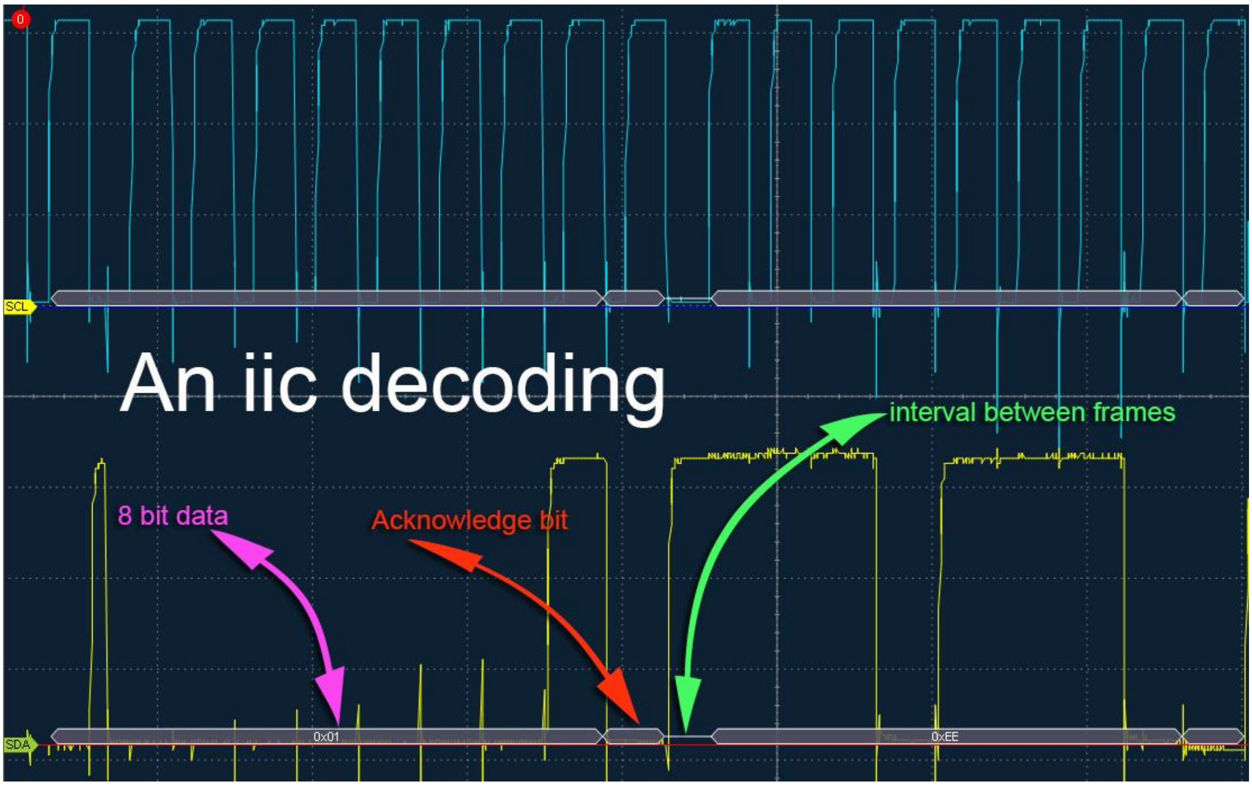
The following uses several practical examples to illustrate the decoding steps and the results displayed.

1. This is an example diagram of RS232 protocol decoding in UART communication:



Procedure	Description
1	BaudRate is 9600, which is set according to the frequency when the hardware sends data in this example. Calculated by: 1.0 / 9600 ≈ 0.00010416666666666667. More accurate calculations are given to the oscilloscope software. We estimate that the final value is approximately: 104.17us. (How much time each bit takes to measure the length in seconds)
2	DataBits is 8bit, and the value is obtained according to the hardware circuit parameters in this example.
3	Parity is Odd. (If not, it can be set to "None" and the oscilloscope software will ignore it).
4	StopBits is One, and the value is obtained according to the hardware circuit parameters in this example.
5	Start bit + DataBits + Parity + StopBits = 1 + 8 + 1 + 1 = 11 bit.
6	11bit * 104.17us ≈ 1145.87us. (Time of each frame of data)
7	In the oscilloscope software Time gear, the X axis of the 1ms gear position takes 1ms per grid. The X-axis grid is about 1145us, which is a relatively appropriate time gear. The periodic waveform density interval in the screen is appropriate, which can read the decoded data well, and the success rate of oscilloscope software in analyzing data will be greatly increased.
8	For transient discontinuous signals, it is recommended to use the trigger function to capture; Use the software's pause and left and right move shortcuts (Ctrl + <-) / (Ctrl + —>) to help analyze the signal.
9	In this example, when RS232 sends a signal, each bit will be “bitwise inverted”, so select: “bit invert Yes”
10	In this example, each frame of data is sent from the high bit of 8 bits, so choose "databits invert No".
11	In this example, when no data is sent, the IO port defaults to low level and the data sent is high level, so choose "enable voltage high".
12	The data sent is: 0xFF 0xEF 0x01 0x02 0x03. Finally, according to the display results, the sending is correct.
13	What needs to be emphasized is Parity. If the check bit is found to be inconsistent with the check bit after analyzing the received waveform, it will automatically assume that this is a frame of error data and it will be discarded without the block diagram showing the parsed result (but with the waveform).

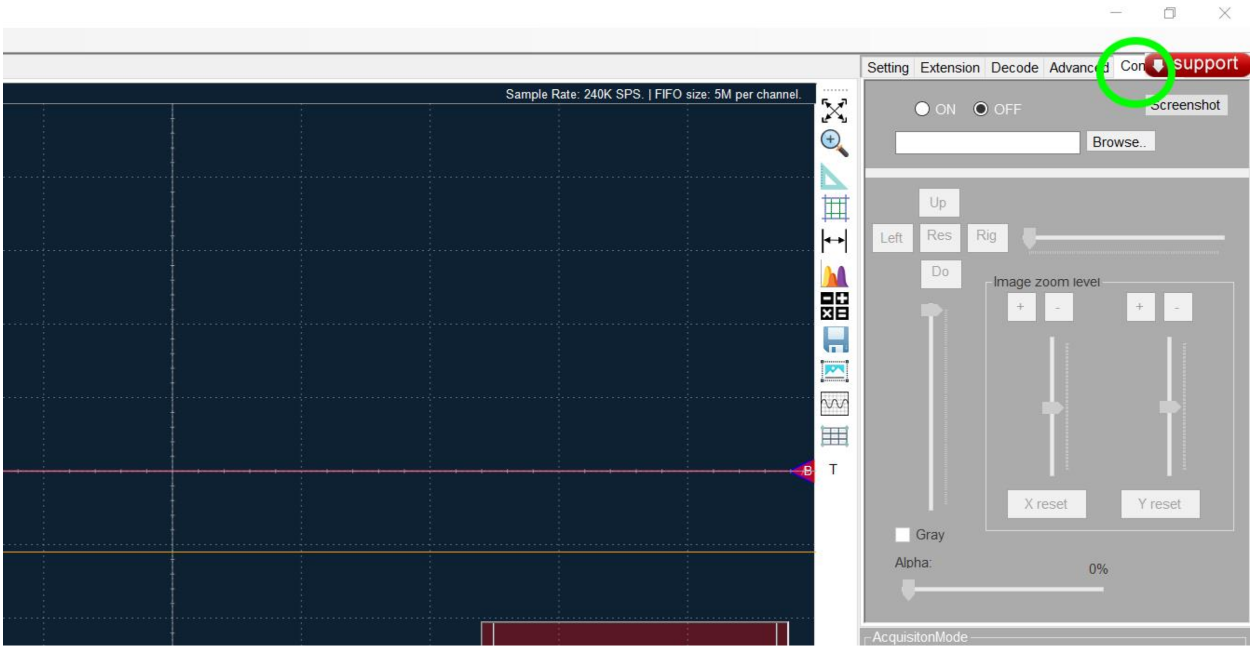
2. This is an instance drawing of IIC decoding:



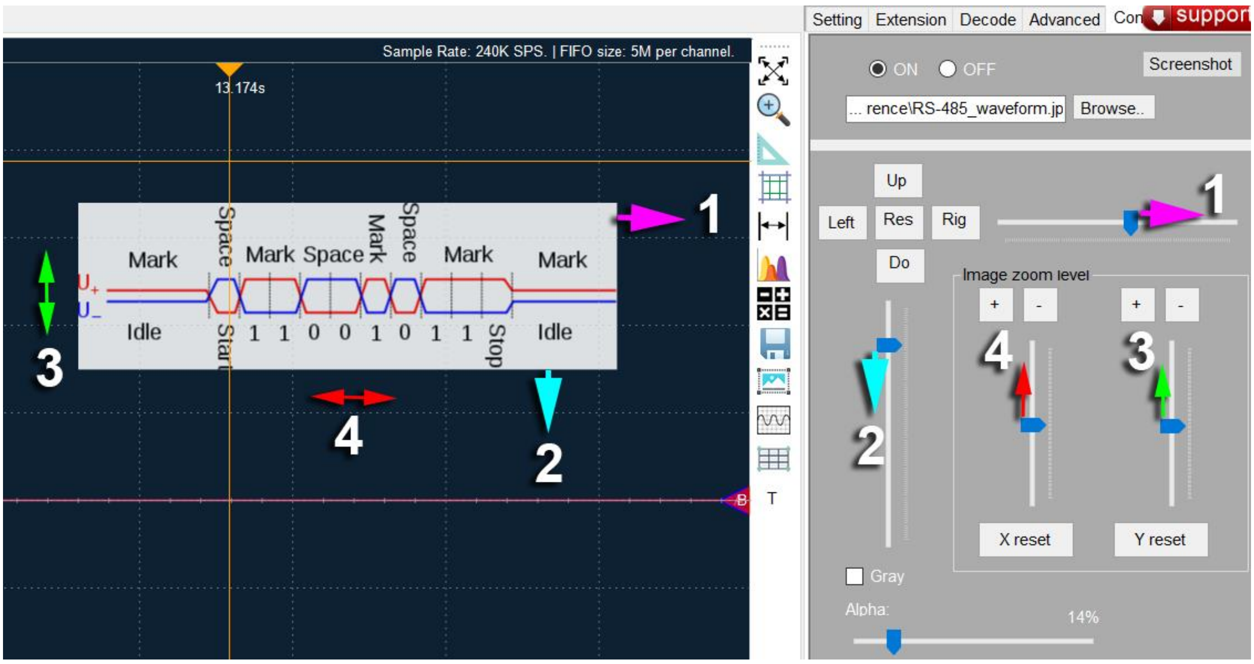
Procedure	Description
1	Probe of channel chA is connected to the SCL circuit.
2	Probe of channel chB is connected to the SDA circuit.
3	Select the appropriate oscilloscope software Time gear.
4	For transient discontinuous signals, it is recommended to use the trigger function to capture; Use the software's pause and left and right move shortcuts (Ctrl + <-) / (Ctrl + —>) to help analyze the signal.
5	In this example of IIC communication, each bit has not been "bit-reversed", so choose "bit invert No".
6	In this example, each frame of data is sent from the low bit of 8 bits, so choose "databits invert Yes".
7	When selecting the oscilloscope software Time gear, at least ensure that one frame of complete data can be included in the software waveform display area.

9. Reference comparison

This function allows users to select picture files from PC and import them into waveform plotting area as the background of acquisition waveform drawing. Used for real-time acquisition of waveforms and imported pictures for reference or comparison. The reference comparison function is shown in the tab page on the right side of the software as follows :



Select the "browse" button, import the picture file, and select the "on" button, the picture will be displayed in the drawing area as the background. The imported image can be moved left and right or zoomed in and edited, and changed to grayscale or transparency.



1	Move the Image to the right
2	Image down
3	Image enlargement in Y direction
4	Image enlargement in X direction

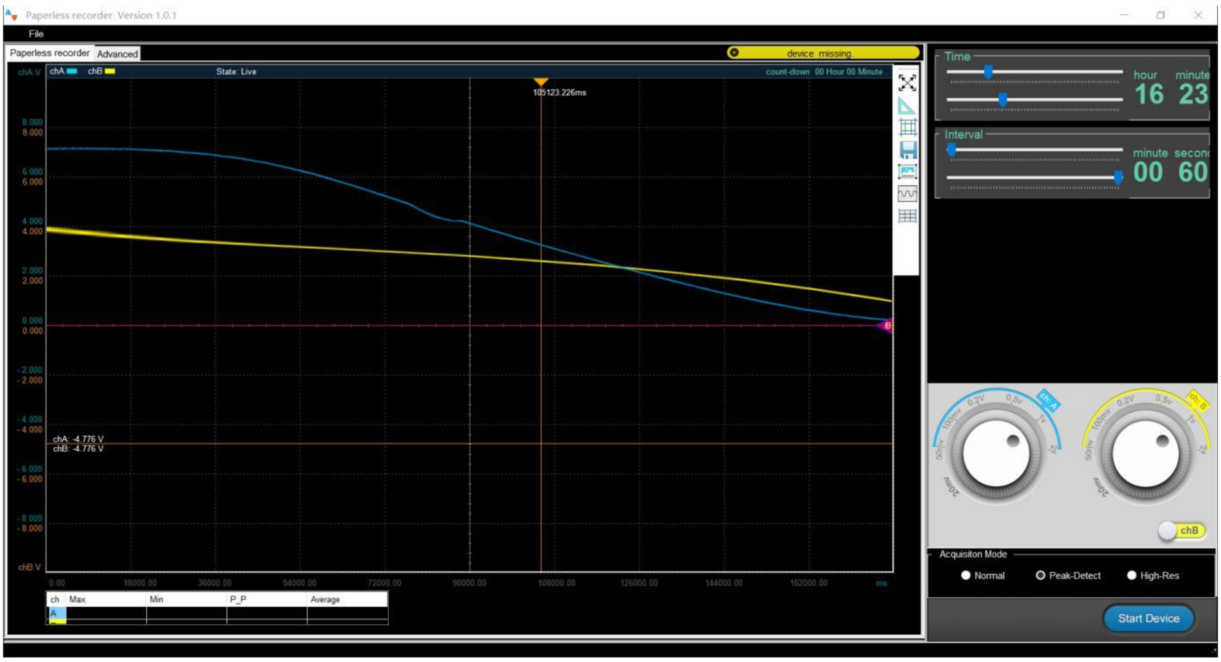
10. Paperless Recorder

This chapter introduces the basic concepts and usage of the paperless recorder, a software functional extension of the virtual oscilloscope hardware.

10.1 Basic Concepts of Paperless Recorders

A paperless recorder is a data logger or data acquisition device used to record measurement data over time. A paperless recorder based on virtual oscilloscope hardware has the ability to record the collected or computed data in a storage system inside the software on a time basis, without consuming any paper, pen or ink. Common collected data are voltage, current, etc.

10.2 Introduction to Paperless Recorder Software



Common software interface

The Recorder software has an interface consistent with the oscilloscope software, so to be familiar to the user.

Equipment monitoring

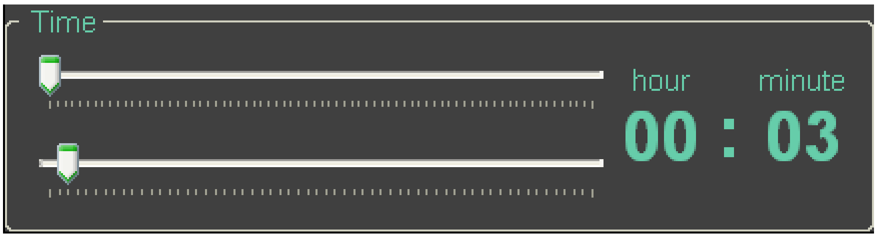
After the software interface is opened, the OSCxxx device status will be monitored in real time. When the hardware device is connected to the USB port of the PC, the software interface will display a blue background and a message.

If the hardware get disconnected or the software have no access to the device, then the display background will become yellow, showing a text alert.

Note
The paperless recorder software has exclusive access to the OSCxxx device. Therefore, the device can be used just with one software at a time.

10.2.1 Set the Total Record Duration

This panel allow to set the recording duration; it can be set in the range 1 minute ~ 3 days.



10.2.2 Set the Sampling Interval

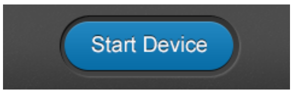
This panel allow to set the sampling interval from 1 second to 1 hour.



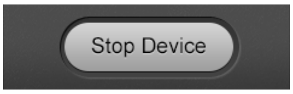
Note
The sampling interval cannot be greater than the total recording duration, otherwise it is meaningless.

10.2.3 Start and Stop

After the driver has been successfully installed, if the oscilloscope is connected when the software is opened, the software automatically turns on the device. If the device is connected before opening the software, it is required to start the device manually by clicking on the **Start Device** button in the lower right corner of the software.

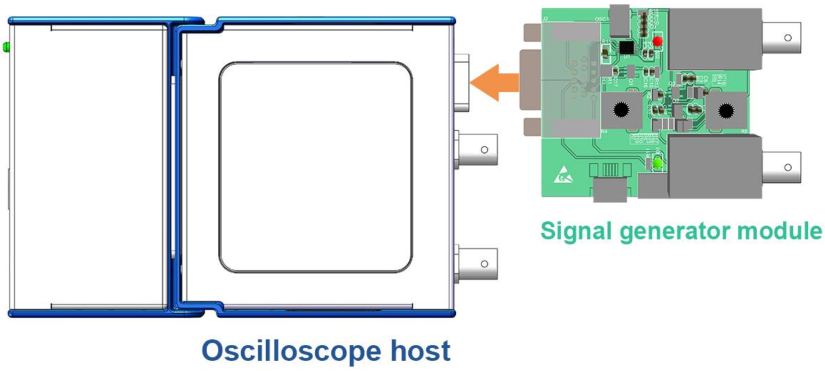


The acquisition can be stopped by clicking the Stop button. The Start and Stop button are actually the same button that change according the status of the oscilloscope. When the USB cable is suddenly unplugged during the operations, the software will automatically stop.

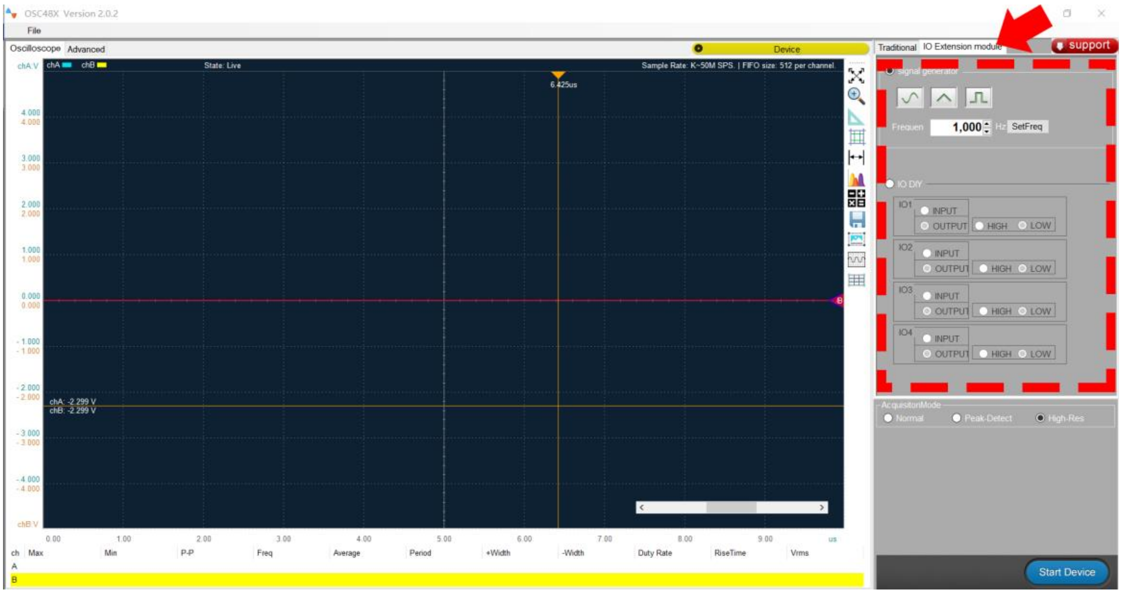


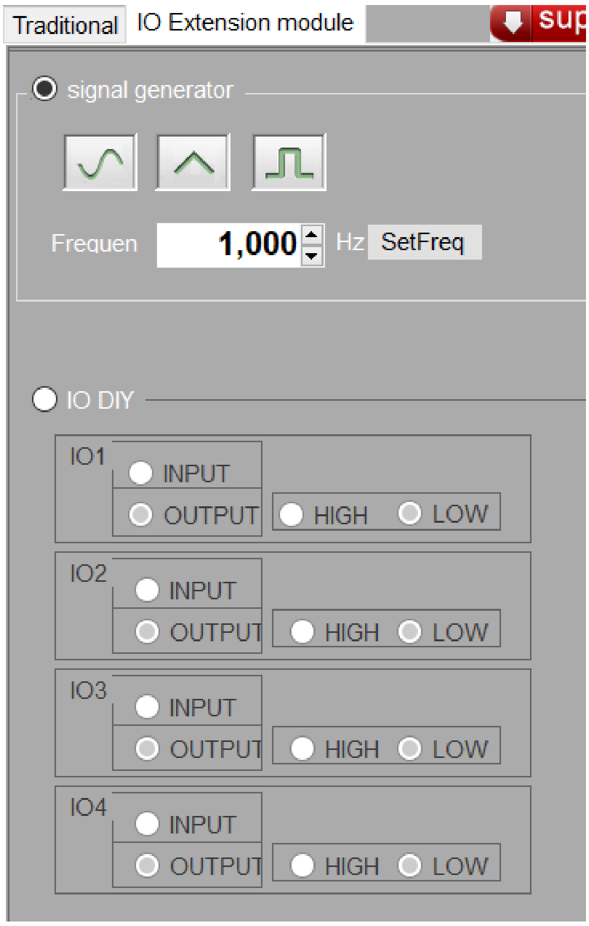
When the device is not used it is recommended to close the software and then to unplug the device's USB cable.

11. Signal generator module



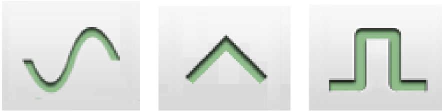
Some devices have the ability to be integrated with signal generator moudle. So if you receive a Signal generator module, you may find the corresponding feature in the host devices' software:



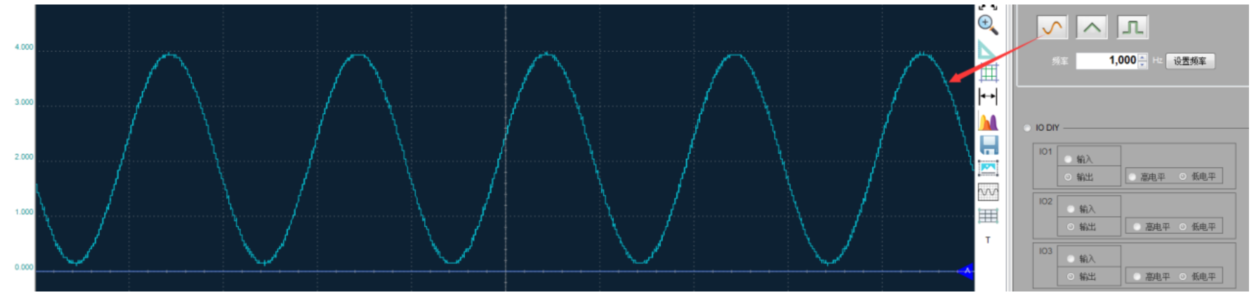


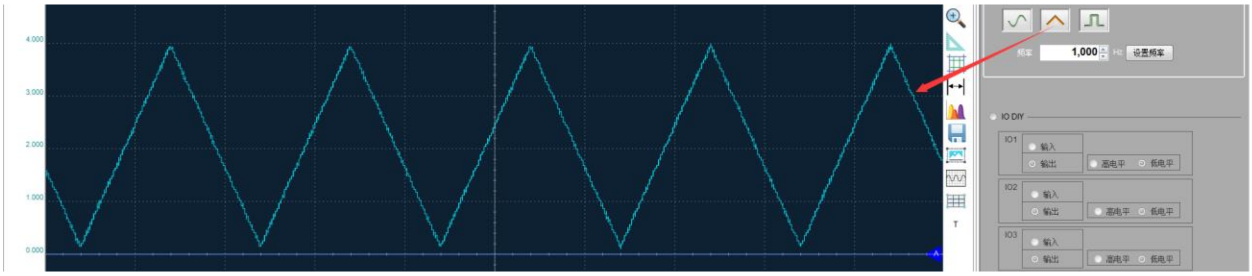
11.1 Signal waveform type

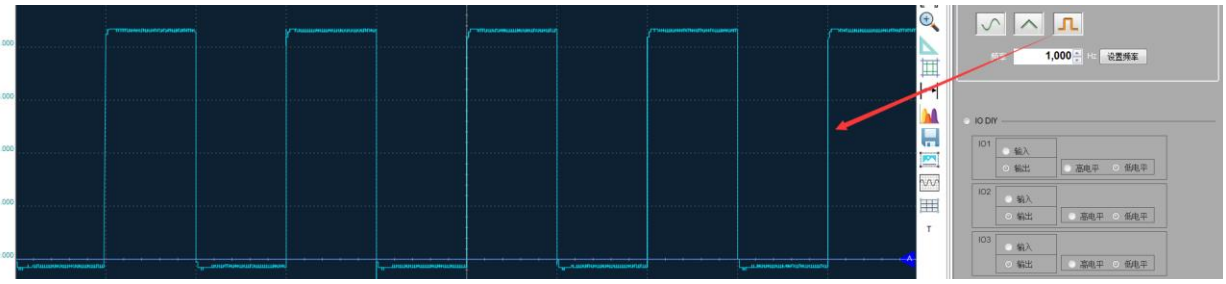
Three types waveform could be selected by buttons: sine waveform, triangle waveform and square waveform.



We can test the signal generator output with the host oscilloscope:







11.2 Signal waveform frequency setting

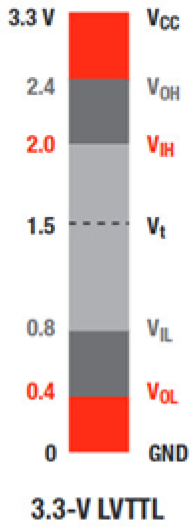


By default , the frequency is set to 1K Hz. We can type a number or click the up/down button for a new frequency and then click “SetFreq” to initiate a frequency change.

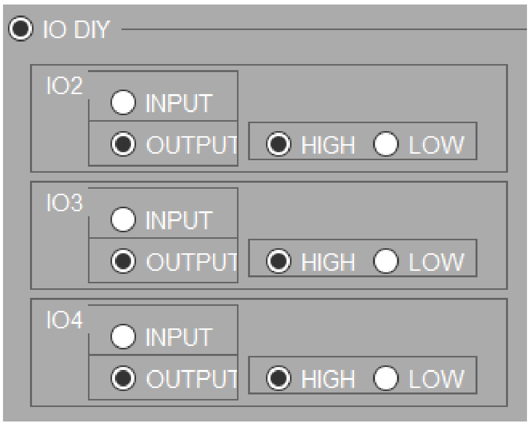
Waveform type	Lower limit of frequency(Hz)	Upper limit of frequency(M Hz)
Sine	1 Hz	13M Hz
Triangle	1 Hz	8M Hz
Square	1 Hz	1M Hz

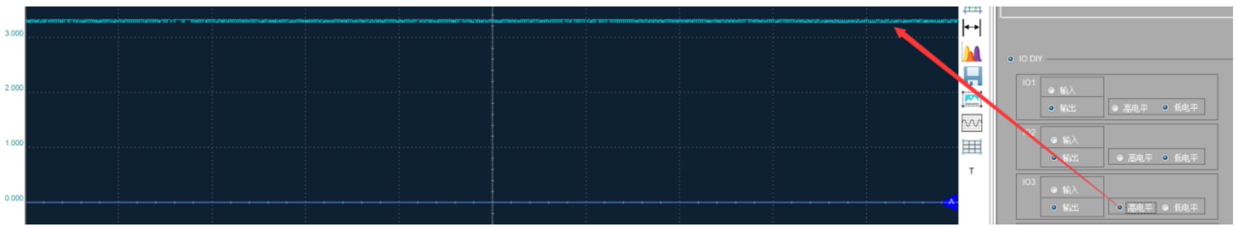
12. GPIO control function

Some devices have this GPIO control function, allow us to implement several IO pins TTL voltage output control or input state detect.These GPIO follow 3.3V TTL level logic.

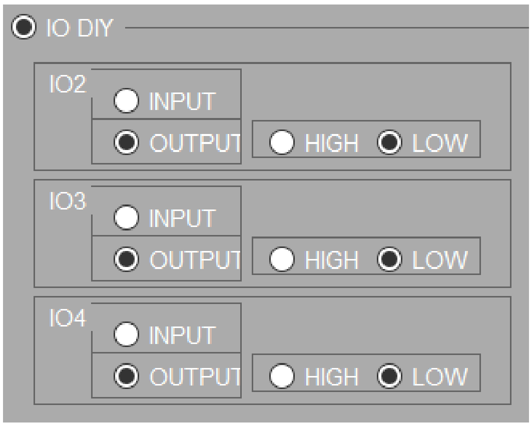


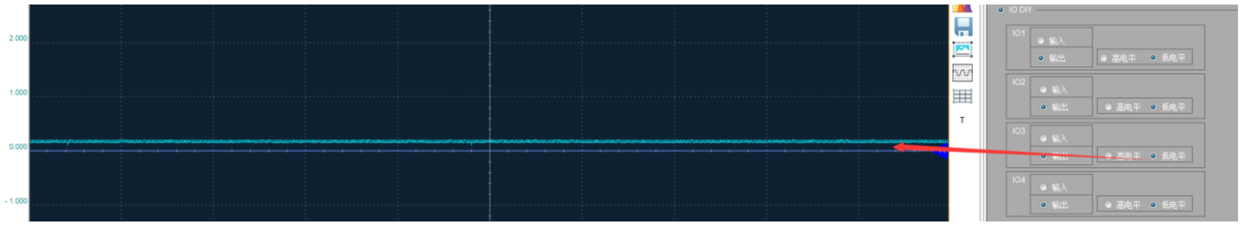
High level GPIOs output:



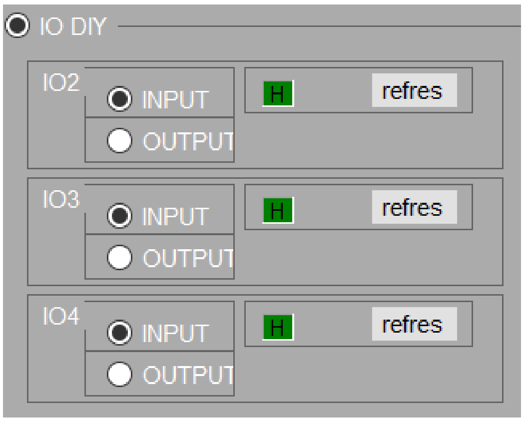


Low level GPIOs output:

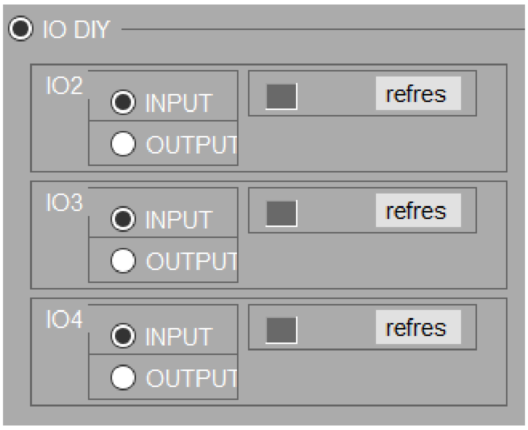




GPIOs detect High level inputs:

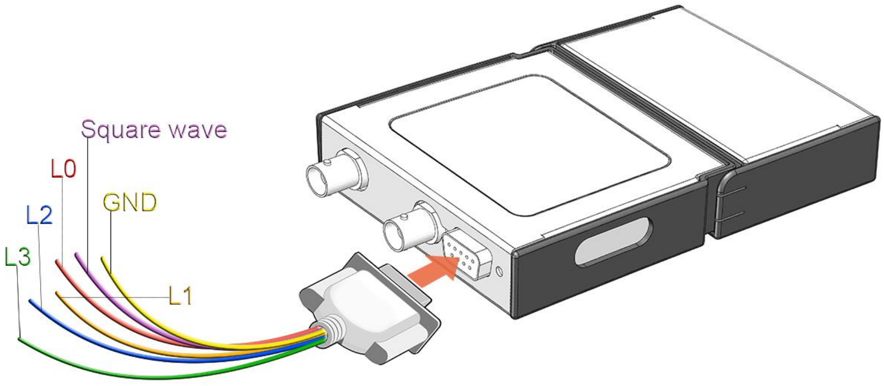


GPIOs detect low level inputs:

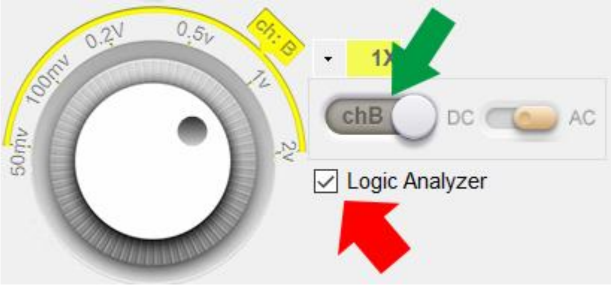


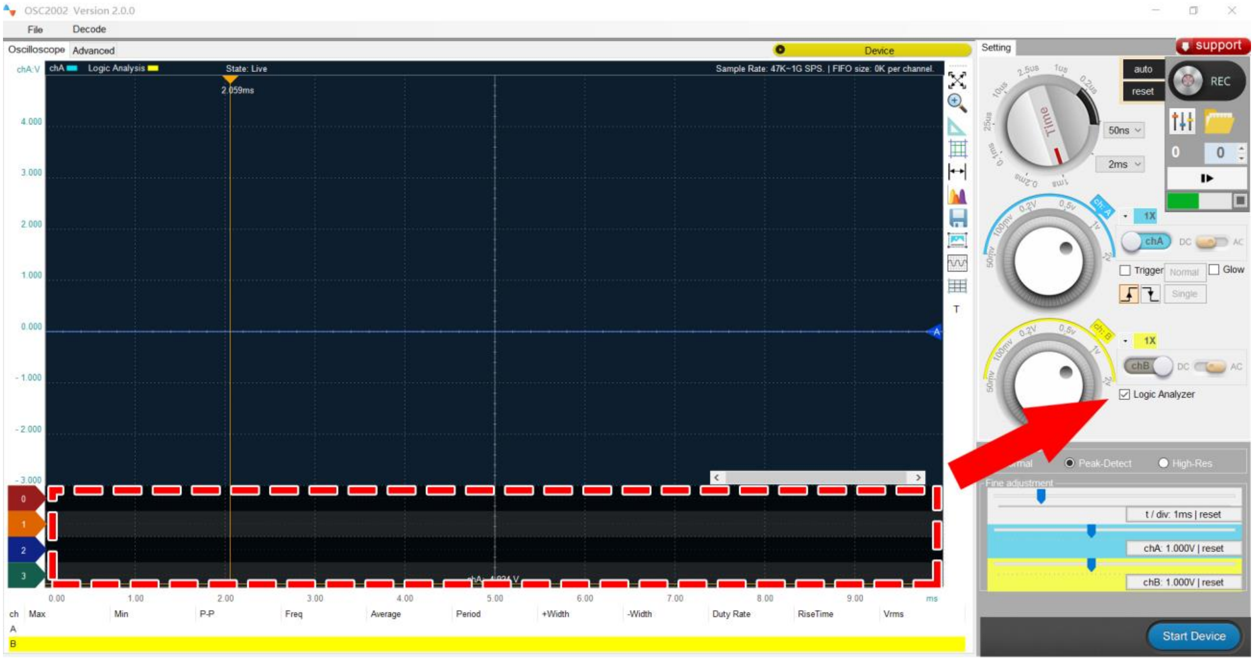
13. Logic analyzer module

Some devices have the ability to be integrated with logic analyzer moudle.

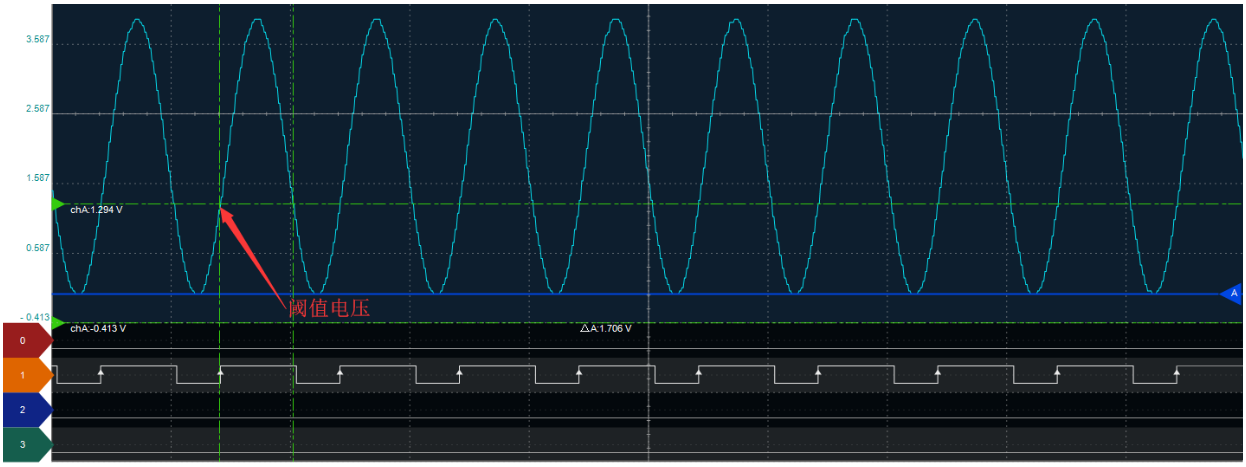


In the channel B setting panel area, we could initiate the logic analyzer. We can use either logic analyzer function or the channel B, so the channel B on/off button would be set to off automatically while logic analyzer is initiated.





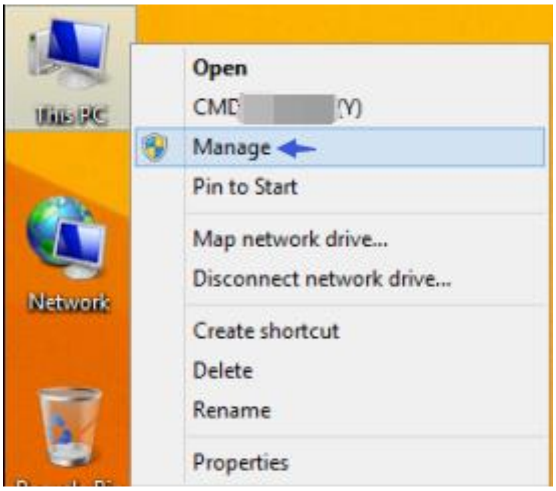
channel A analog waveform could be dispalyed with the 4 logic channels' waveform at the same time , and share the same time axsis.



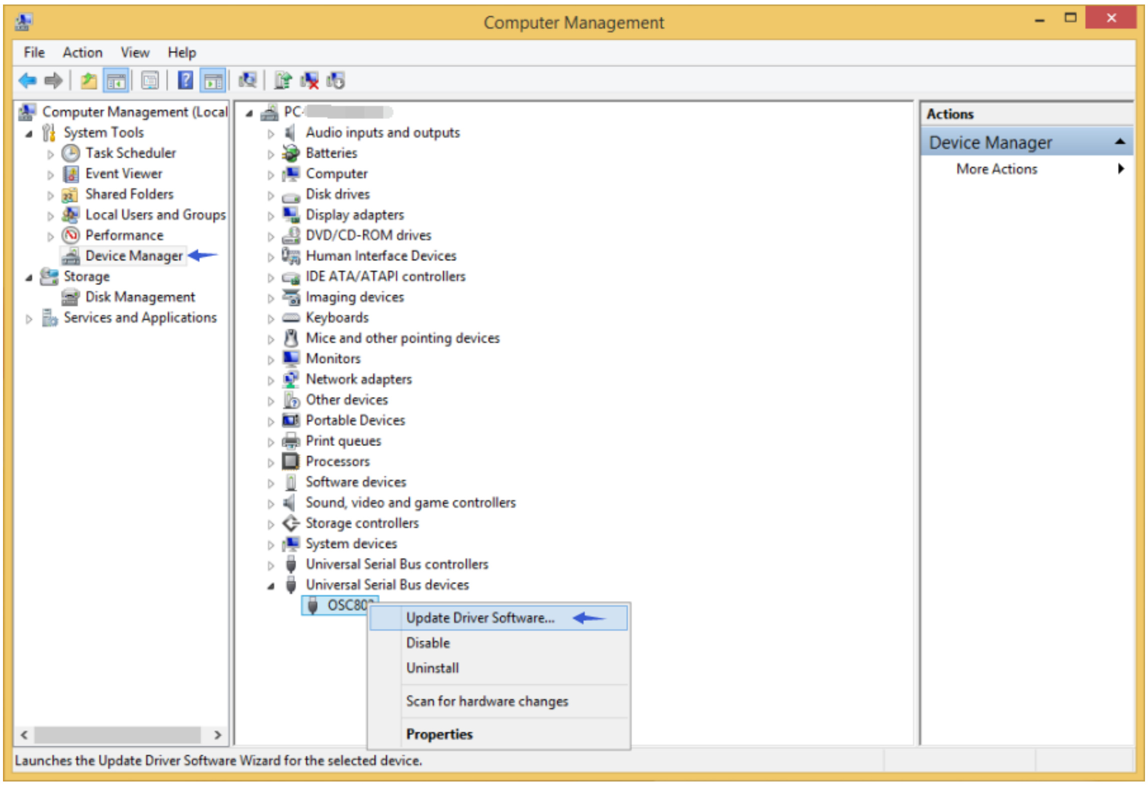
Appendix I : Driver installation under exceptional circumstances (Complete and detailed driver installation steps)

Manual install of the driver**:**

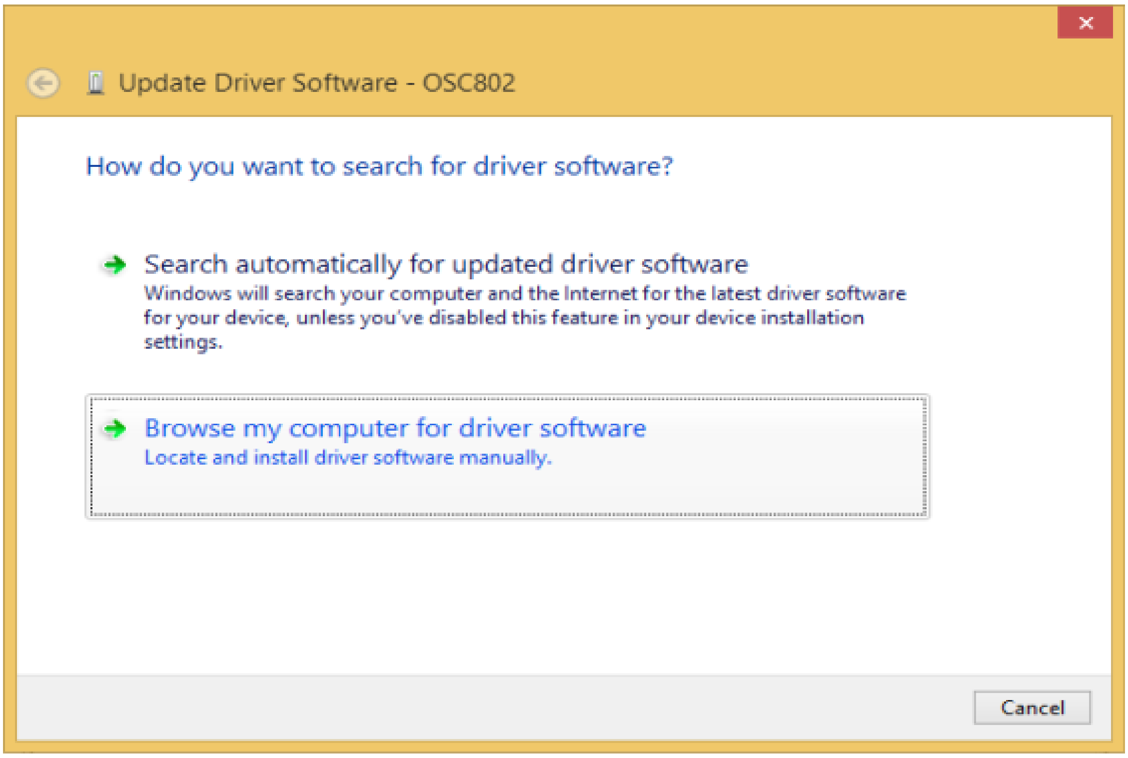
1. Right click on **Computer** and select **Manage**.



2. Enter in the **Device Manager**, and search for the device called **OSCxxx** inside the section **Other Devices** (if not found, unplug and plug again the device and wait), then right click on the device and select **Update Driver Software**:

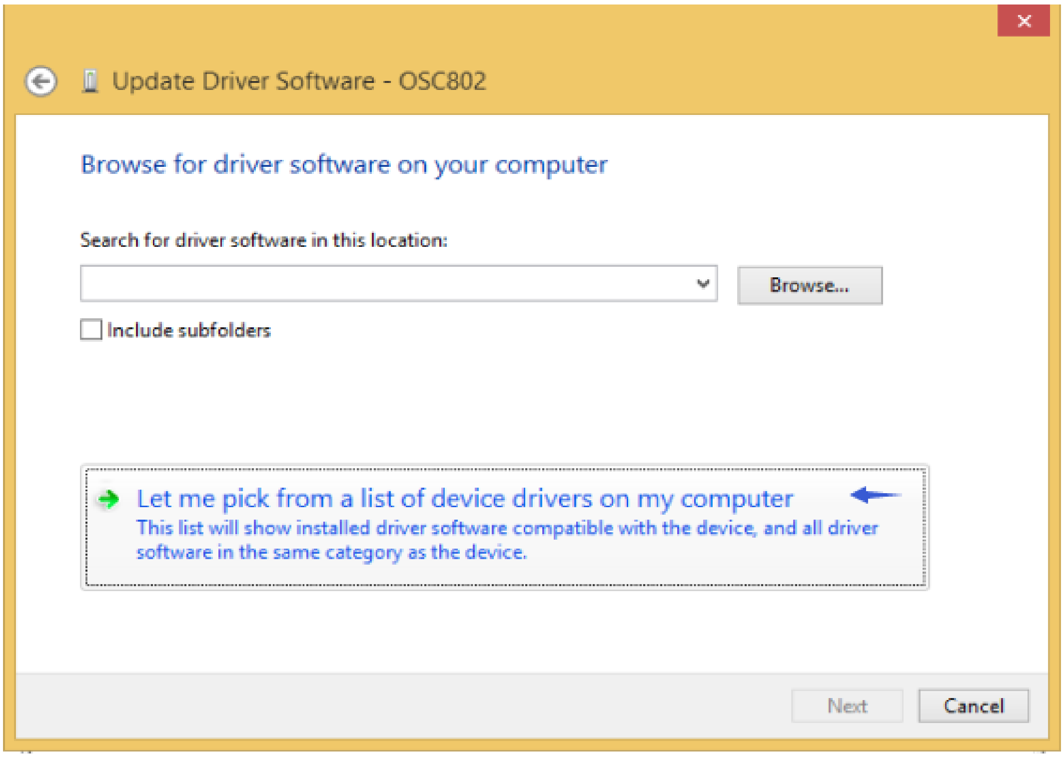


3. In the next dialog box select " Browse my computer for driver software ":

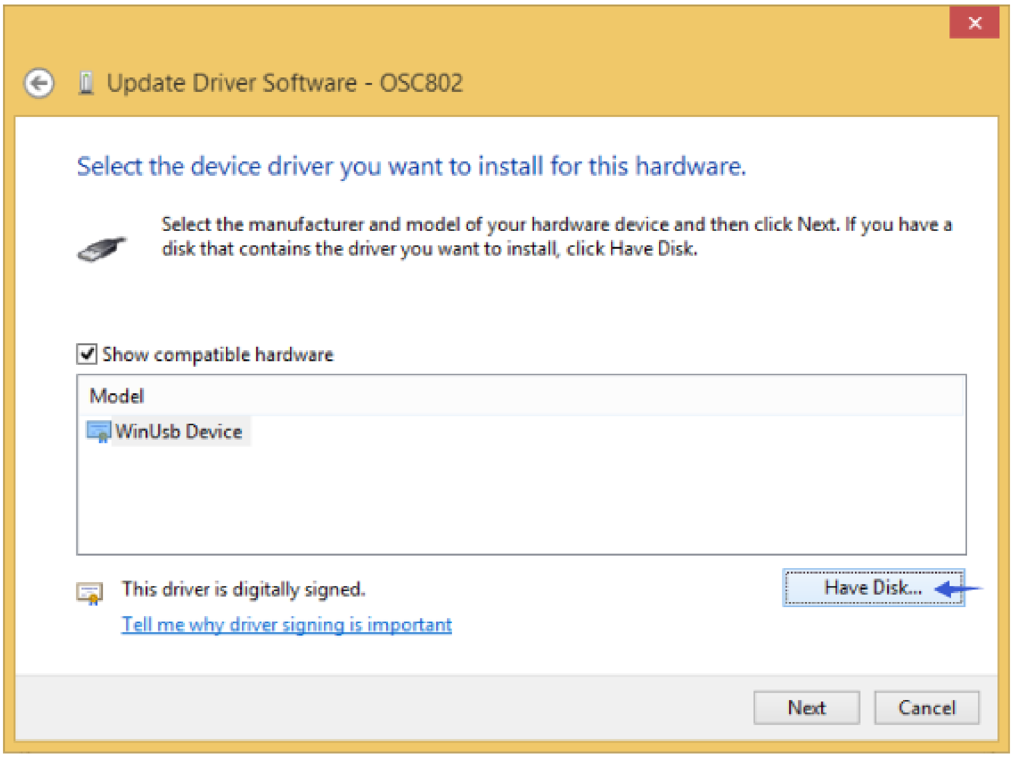


4. In the next dialog box, select " Let me pick from a list of device drivers... ":

Note
In many cases, in post-patched systems or systems with strict permissions, this second option is easier to succeed.

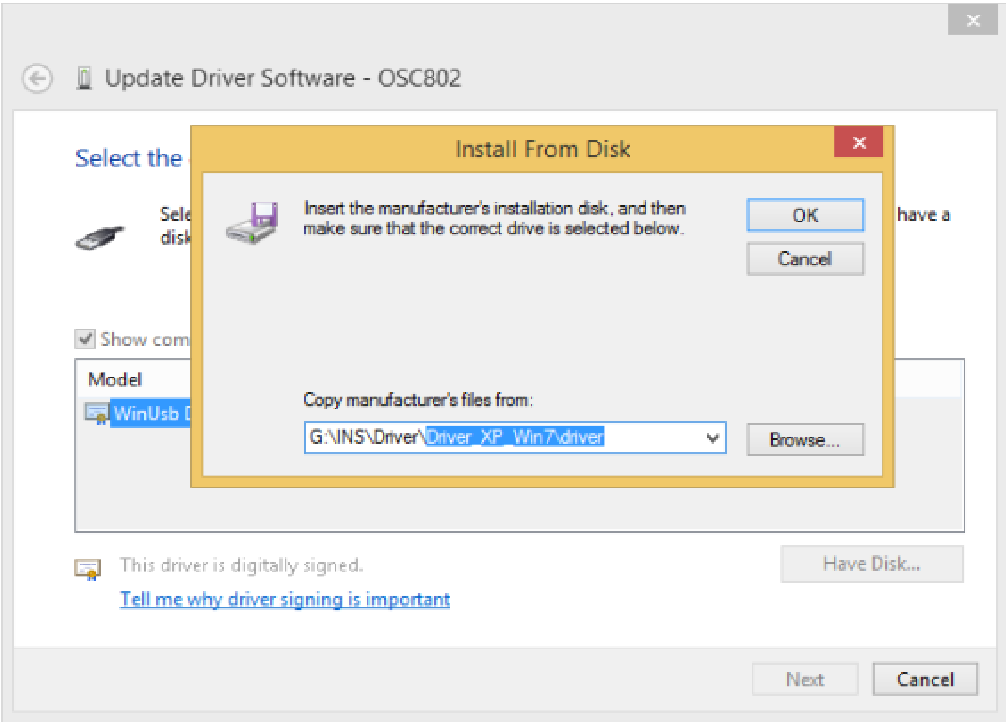


5. In the next dialog box, select "Have Disk..."

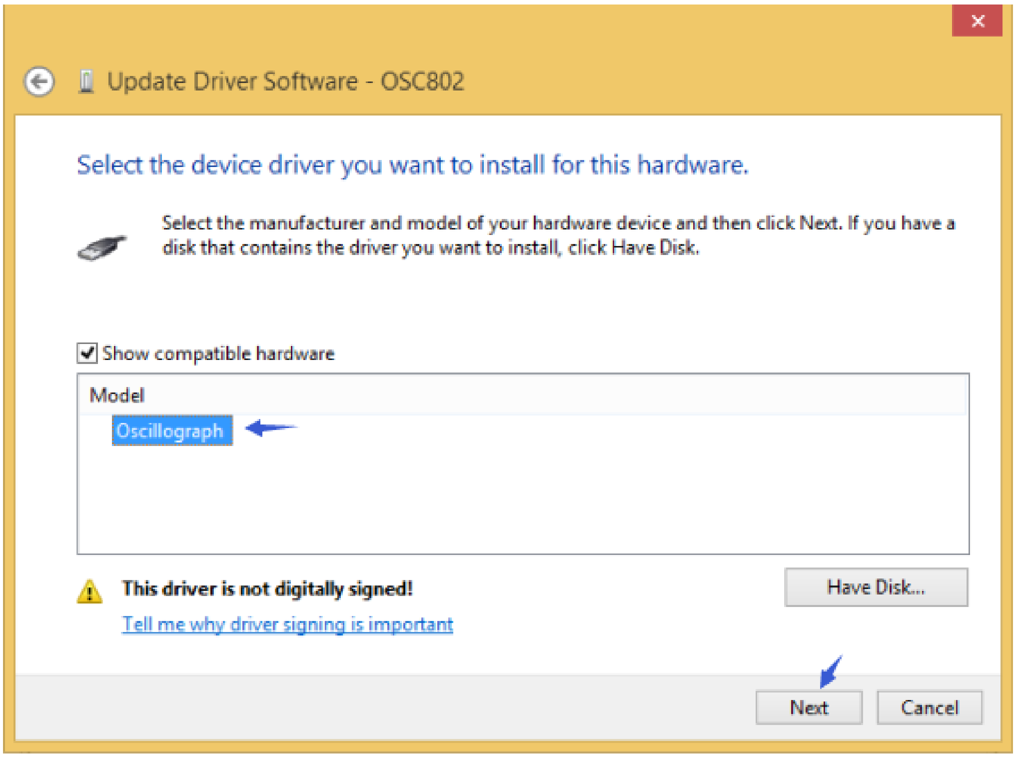


6. In the next dialog box, select **Browse** to select the driver path like " Driver_XP_Win7\driver\UsbLjtMS.inf " and click **OK**.

> **Note:**
>
> The driver XP_Win7 (Driver_XP_Win7\driver\UsbLjtMS.inf) is compatible with all other Windows versions.



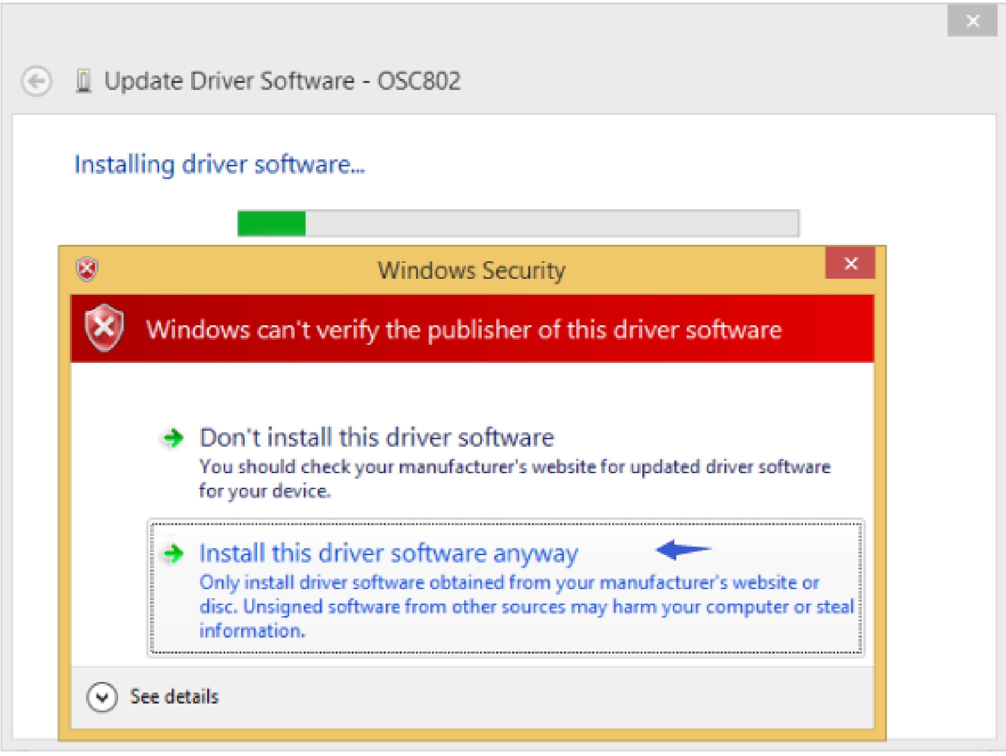
7. In the list of compatible hardware, select **Oscillograph** and then click on **Next**.



8. Select "Install this driver software anyway" :

Note:

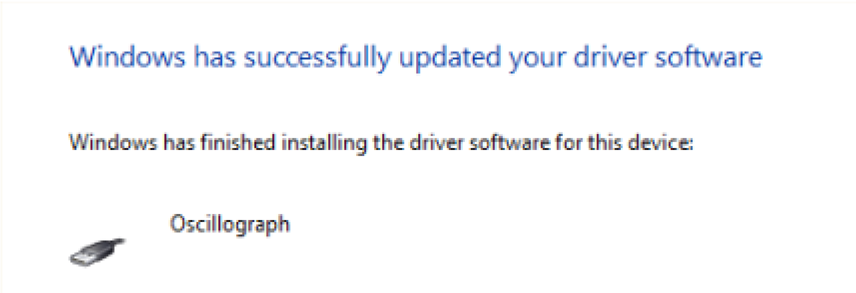
In systems with more restrictions a warning window will appear. However, you can install the driver anyway since it is safe.



(Installation finished)

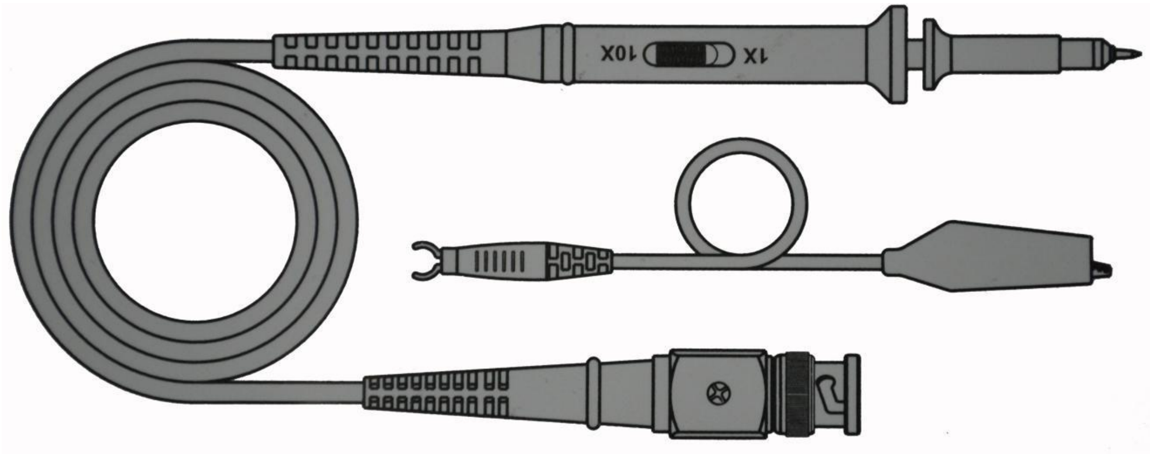
Note

In some systems, our products will be shown as "WinUsb Device", but after the correct driver installation it will be shown with the correct name.



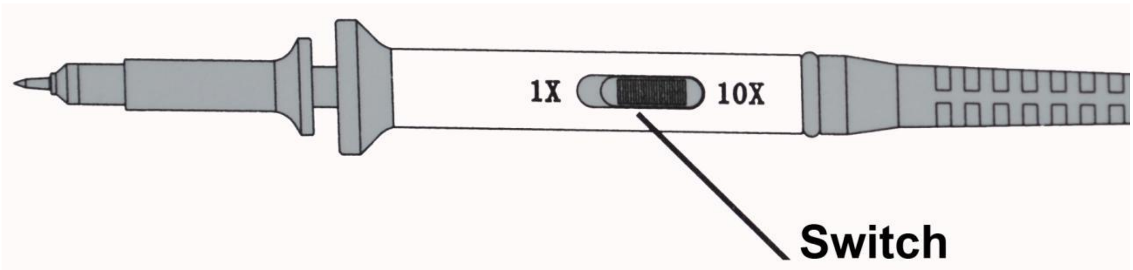
Appendix II: Probes

The device is provided with two 40MHz probes with 1X/10X attenuation selector, as shown below:

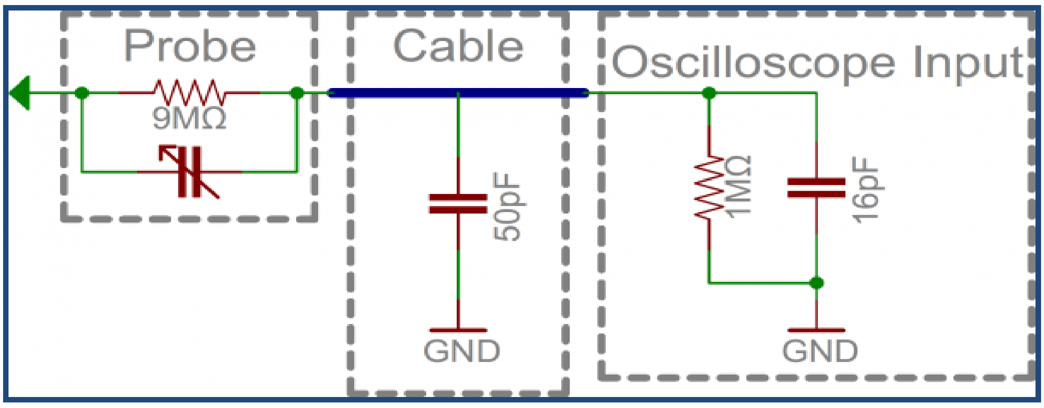


1. Attenuation Selector

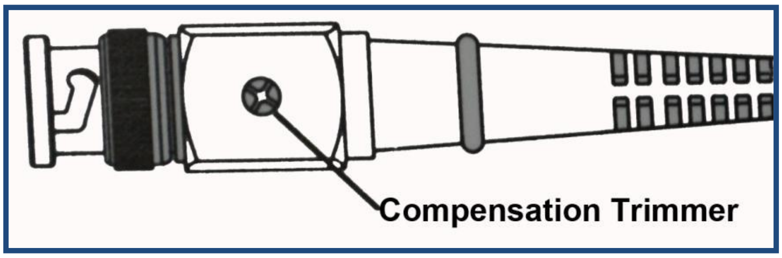
When the attenuation selector at the probe position is toggled to the 1X position as shown below, the input signal connected by the probe tip is sent to the oscilloscope without attenuation. Since the input range of the device is ±5V, then just a signal in this range can be measured. When the attenuation selector is moved to the 10X position, the input signal is sent to the device attenuated by a factor 10. In this case you can measure signals within the range of ±50V.



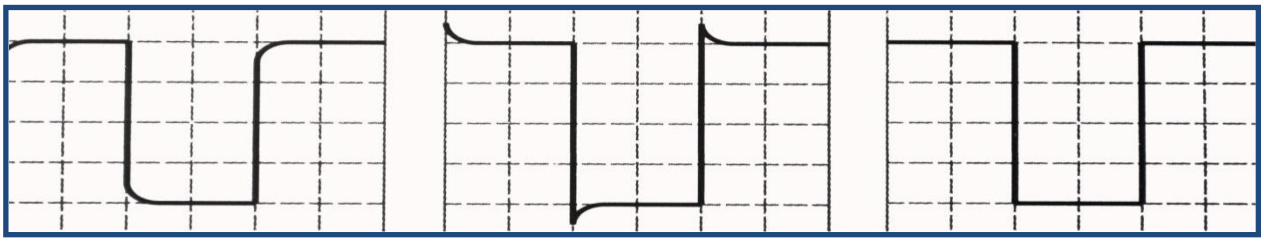
The 10X selector has better frequency characteristics and wider bandwidth, so you can use it when dealing with bandwidth and frequency limitations, for better measurements.



2. Compensation Trimmer

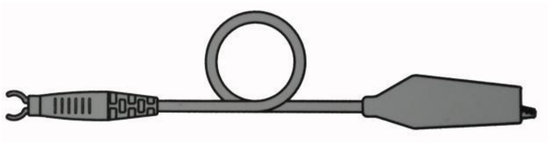


When using the 10X attenuator, the frequency characteristic of the probe can be corrected by adjusting the compensation capacitor on the probe. For this calibration set the probe to the 10X position and connect the probe to the reference signal generated by the device (square wave). Adjust the compensation trimmer until you can see on the screen a proper square waveform.



X1 position cannot be used for this probe calibration.

3. Probe Ground Clip



The probe ground clip is directly connected to the ground of the virtual oscilloscope circuit and connected to the PC ground via USB cable. When using a PC powered by the power outlet, the PC ground is connected to the ground through the three-core power jack. Make sure that the ground of the probe is connected to the ground of the circuit under test and to the ground used by the PC; otherwise you can have current leakage, short circuits or measurement errors. In severe circumstances, the device may also be damaged. See *Chapter 4* for details.